

# PC PRO

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AWARDS  
ISSUE

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# Windows 10 laptops

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## Boost your battery life

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Capability

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THERE'S NO

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# Editor's letter

**THERE WAS A** time in my life when I sold washing machines at John Lewis. In all honesty, I wasn't very good at it: sales patter has never been my strong point, and I'd often end up just chatting to customers. Very occasionally, to the relief of my boss, they would buy a washing machine out of a combination of sympathy and boredom.

Our sister department was Returns, the lucky chaps who handled all the failed washing machines, vacuum cleaners, TVs and other electrical goods that people like me sold. There was one person I particularly liked talking to – let's call him Returns Gerry – because he combined a bitter, twisted and deeply funny view on life with genuine, hard-won insight. "Don't sell xxx brand," he'd warn me, as xxx was a particularly unreliable make. "They're xxxx awful," he'd add, with the xxxx not standing for a brand.

I spent about a year selling just enough washing machines to not get fired. They eventually moved me out of harm's way and into the kitchen-planning office, where my chats with customers could be more fruitful. By that year's end I was convinced that whatever I bought from then on was going to be of the best quality I could afford. After all, once a few months have passed, you've forgotten how much it cost and you're just stuck with a piece of hardware. It might as well be one you enjoy using.

Now, you could follow the same path as me: spend a year on an electrical retailer's shopfloor, ingratiate yourself with its equivalent of Returns Gerry and then, finally, make your choice. Or you can turn to p34, where we've garnered the wisdom of several thousand *PC Pro* readers to rate the best brands in all the different sectors – laptops, tablets, phones, online retailers, you name it. Think of it as your very own, giant, surly Returns Gerry.

While we've somehow forgotten to ask about washing machines, there's one set of results I'm particularly interested in this time around: ISPs. I've been with BT for several years now, and during that time I've seen my fee creep up in reverse correlation with my satisfaction. Of course, they lure you in with special offers and bundled extras, but I'm starting to think that all I really care about is fast, reliable broadband.

Like so many others, I opted for a bundle that includes TV services, but times have changed. Now, I turn to on-demand services such as BBC iPlayer and Amazon Instant Video for my televisual entertainment. The BT box that sits under my TV has become little more than a glorified video recorder, and a magnificent lesson in how not to design a user interface. The only justification I can see for the ridiculous maze of menus I'm required to navigate simply to access iPlayer is that BT wants me to throw the box out of the window so it can charge its "generous" repair fee.

But it's okay, Tim, breathe easy. The good news, as explained in our Switch your ISP special on p42, is that it's now incredibly easy to switch. No more messing around with MAC codes – just pick a deal and go. All I need to decide upon now is which broadband supplier to go for, although I'm greatly swayed by the scale of a certain Rochdale-based provider's winning margin.

Oh, and if you're wondering what washing machine to buy – and if you can afford it – always go for a Miele.

**Tim Danton**  
Editor-in-chief

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**Professor Alan Winfield** Brought up on a diet of Asimov novels? So were we, which is why we're fascinated by Professor Winfield's efforts to create an ethical robot. See **p116**



**Michael Passingham** Windows 10's arrival means you should treat yourself to a new laptop. Michael spent this month finding which is best. See **p74** to discover the winner



**Simon Brew** More people are using ad-blockers, which creates two problems: how do brands convince you to buy? And how do websites survive? Simon reveals all on **p16**



**Nicole Kobie** The netbook has risen from the ashes in the form of the cheap and no-nonsense Asus EeeBook X205TA. Nicole welcomes it back like an old friend on **p25**





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What's the most expensive piece of IT you've ever bought?

"It still hurts that I paid £420 for an inkjet printer in 1998. Mind you, I've probably spent that on ink for my current printer."

"I saved up my pocket money for a fifth-generation iPod Classic, which is still playing my questionable music choices ten years later. Bargain!"

"Two grand for a 21in flat screen, in 2001 or so. I hate to think how little they cost now."

"In 1990 I bought an 8ppm HP LaserWriter 2 printer for £2,000. That's almost £5,000 in today's money compared to around £50 for the equivalent today."

"£250 on a tablet as a cheap replacement for my school's iPad that I managed to smash."

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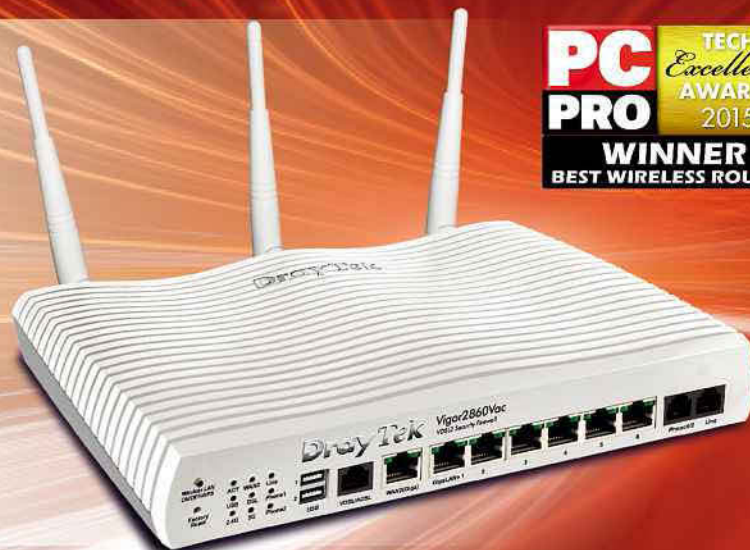
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# Briefing

Background and analysis on all the important news stories

## BT offers better broadband

The telecoms giant has unveiled its vision for the future **p12**

## IFA 2015

We reveal the best products from Berlin **p14**

## PC Probe

Are ad-blockers killing online advertising? **p16**

## The student who destroyed the “safe harbour”

The law that allows tech companies to store EU data in the US could be set to fall. **Nicole Kobie** reveals how an Austrian law student could massively disrupt the tech giants



Images: (c) 2011 europe-v-facebook.org

**US TECH FIRMS** could be forced to store European data locally because of a legal complaint against Facebook from an Austrian law student.

Max Schrems is a privacy activist who began his battle against the social network's use of personal data in 2012. In fact, he's the reason it's possible to download your personal data from the site.

Now he might be making life even more difficult for Facebook and other multinational tech firms. In 2014, the Irish data protection commissioner refused to investigate a complaint from Schrems' group "Europe versus Facebook" regarding where the social network holds data, arguing that the company was protected by so-called "safe harbour" laws, under which the EU deems American data protection strong enough to protect users.

However, after Edward Snowden's revelations of NSA snooping, Schrems

challenged the ruling, stating that the US couldn't be trusted to look after Europeans' data. He's now been backed by one of the EU's leading legal minds, advocate general of the European Court of Justice, Yves Bot, who has written an opinion that national data authorities should

“Schrems challenged the ruling, stating that the US couldn't be trusted to look after Europeans' data”

be able to suspend safe harbour to protect citizens from the “mass, indiscriminate surveillance” carried out by US intelligence services.

While Bot's 40-page opinion isn't binding, the court tends to follow his

**ABOVE Austrian Max Schrems began his battle against Facebook in 2012**

advice. If the ECJ does, it could be the end of safe harbour laws, meaning new regulations will need to be drafted or tech firms will be forced to keep European data off US servers.

Schrems told *PC Pro* that bringing down the safe harbour laws were always his main aim, adding in a statement: “It is great to see that the advocate general has used this case to deliver a broad statement on data transfers to third countries and mass surveillance.”

### ■ Major blow for business

Deema Freij, deputy general counsel and privacy officer for cloud firm Intralinks, said a decision against safe harbour “would have a major impact on global businesses”, and mean companies wouldn't be allowed to transfer EU data to the US. That was echoed by Vinod Bange, head of data protection and privacy at law firm





**LEFT** Schrems aims to protect EU citizens from mass surveillance by US agencies

Taylor Wessing, who agreed that it will impact many businesses, “not just the social media giants.”

“For many technology products and services, data flows in and out of the EU and US, and such a blow to US safe harbour could impact on data-driven business, including those in the UK as well as across the rest of Europe,” Bange added. “Let us not underestimate the vast number of companies that will be impacted.”

If Bot’s opinion is upheld by the court, the 4,410 US companies with safe harbour certification – including Microsoft, Apple, Google and others caught up in the NSA “Prism” scandal exposed by Snowden – will have to use other legal grounds for data transfers from the EU to the US.

### ■ Time to celebrate?

The law student has made a name for himself – though tech firms may now be using “Schrems” as a swear word – but he’s not celebrating yet. “There is nothing won so far – we have to see what the court says in the end,” he told *PC Pro*.

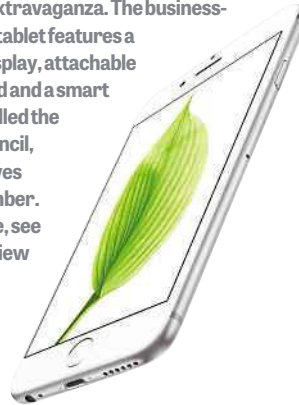
Freij agreed. “To mangle a Churchill quote, it’s not the end, but it’s the beginning of the end,” she said. She also added “it’s clear that no matter the final decision, safe harbour is rapidly losing credibility”. ●

## Five stories not to miss

### 1 Apple announces iPhone 6s and iPad Pro

Apple updated the iPhone and iPad mini, and unveiled a new Apple TV with Siri, but it was the iPad Pro that stood out at its latest launch extravaganza. The business-

focused tablet features a 12.9in display, attachable keyboard and a smart stylus called the Apple Pencil, and arrives in November. For more, see our preview on p61.



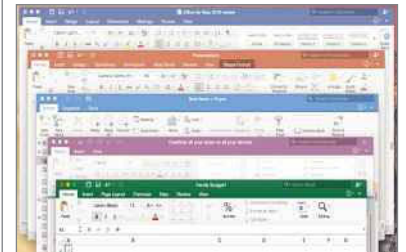
### 2 European airlines get high-speed in-flight broadband

Airlines in Europe will soon be able to offer high-speed Wi-Fi in the air thanks to a deal between Deutsche Telekom and Inmarsat that will see fliers flipping between satellite and ground networks. Lufthansa will launch the service in summer 2016, with others following suit in 2017.



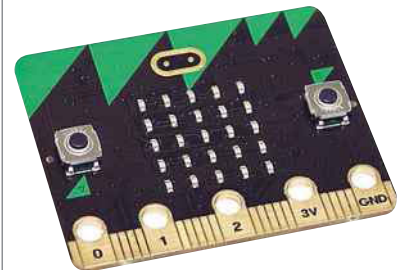
### 3 Office 2016 arrives with a yawn

Microsoft has released the latest version of its productivity suite, Office 2016, but there are few major changes in the update. Anyone on an Office 365 subscription will get an update for free, while everyone else will have to shell out. See our review on p63.



### 4 Mobile price worries after Ofcom price hike

Regulator Ofcom has tripled what it charges mobile operators to use spectrum from £64.4 million to £199.6 million. Ofcom argued that the industry hasn’t previously been paying “market value” for spectrum, but operators reportedly haven’t ruled out raising prices to cover these increased costs.



### 5 BBC’s Micro Bit delayed until 2016

The BBC’s tiny computer was supposed to be handed out to every year seven student in the UK this year. Instead, the Micro Bit has been delayed until next year because of manufacturing problems. Coincidentally, its 1981 ancestor, the original BBC Micro, was also initially delayed.

# THE RESULTS SPEAK FOR THEMSELVES



# BT promises better broadband in bid to avoid breakup

The telecoms giant has unveiled its vision of the future of British broadband, as it hopes to stop regulators chopping off its infrastructure arm. **Nicole Kobie** reveals what to expect over the next five years

LIKE A POLITICIAN making pre-election promises, BT this month unveiled its broadband manifesto for the next five years: minimum speeds of 10Mbps/sec, fibre connections of up to 1Gbit/sec, and improved service. BT isn't trying to win the hearts and minds of consumers, but those of the regulators threatening to spin off its infrastructure arm Openreach.

Openreach is run separately from the rest of BT Group, selling access to its infrastructure to rival ISPs as well as BT Retail. Some of those rivals have been pushing Ofcom to forcibly detach Openreach from BT Group (see *The case for splitting off Openreach*), and the regulator is considering the amputation as part of a wider communications review.

In response, BT has laid out its plan for the future of British broadband, in the hope that its vision will convince Ofcom that BT and Openreach are better together. CEO Gavin Patterson told journalists at a London press event that the plans were "not a threat" of what Britain would miss out on if BT were forced into a messy divorce, but a glimpse of what the duo can provide together.

## BT's broadband pledge

In terms of broadband coverage and speeds, BT wants to set a universal minimum broadband speed between 5Mbps/sec and 10Mbps/sec; extend fibre beyond the existing 95% coverage target; and roll out "ultrafast" connections of 300Mbps/sec to 500Mbps/sec to ten million premises over the next five years.

BT said the first two pledges require government support – a polite term for more taxpayers' money. To extend the current universal service commitment from its existing 2Mbps/sec to 5Mbps/sec or above will require further (unspecified) government investment, although BT is willing to invest too. The range of 5 to 10Mbps/sec will depend on how much money

the government is willing to provide.

Fiona Vanier, an IHS analyst, said 10Mbps/sec is a "good minimum" given the number of devices now connecting to home Wi-Fi, but said she suspected that baseline "may be pushed down to 5Mbps/sec".

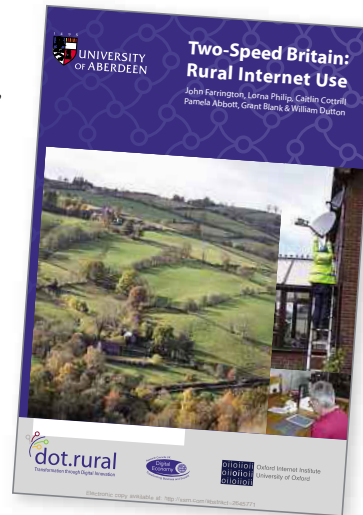
Extending fibre coverage will also require government support. The current part-public funded Broadband Delivery UK (BDUK) project is targeting 95% fibre coverage, and that's expected to be reached by 2017. "That achievement doesn't feel so huge if you're in the final 5%," noted Patterson.

BT believes it can extend fibre coverage further, possibly using money it handed back to BDUK under an agreement to return some public investment if take-up of fibre services exceeded 20%. BT has repaid £130 million so far, and wants that spent on fibre coverage, although Patterson noted: "if there were to be further funding, we do not assume it would all go to BT". Indeed, rival fibre projects have popped up from CityFibre, TalkTalk and Sky.

Patterson said the plans to deliver the fastest fibre lines wouldn't need any extra public money. BT is planning to invest from its own coffers to boost the speed of its existing fibre network, through a combination of fibre-to-the-premises (FTTP) and new technologies, providing 500Mbps/sec connections to 10 million homes and businesses across the UK by 2020. Such premises will be offered 1Gbit/sec connections, where possible.

## Service challenges

A significant complaint against Openreach – whether from ISPs or end customers – is its poor service. To combat that, Openreach's CEO Joe Garner has focused on improving customer service in his 18-month



tenure to date, hiring more engineers, and investing in software to let engineers be tracked on call-outs.

Garner hopes to have 95% of engineers arrive at call-outs on time by 2017, and is also considering letting customers directly contact Openreach, rather than having to go through their ISP. That promise was just one part of Garner's "charter" to improve the service, "which will serve as a minimum standard that Openreach needs to achieve," according to Fiona Vanier.

**ABOVE** The final 5% of Britain waits to see if it will get fibre in the next five years

## The case for spinning off Openreach

However, the charter won't be nearly enough to appease BT's rivals. Earlier this year, TalkTalk CEO Dido Harding said it was "crucial that we now seize this opportunity to structurally separate Openreach".

"It would end BT's ability to erode competition, stimulating innovation, consumer choice and lower prices," she added.

Sky responded to the charter with similar sentiments, with group CEO Jeremy Darroch arguing a separation would provide "the capacity and

incentive to invest" and "lower prices for customers".

But there's another reason rivals may want the split to take place. Andrew Ferguson, an

**“Two of BT's pledges require government support – a polite term for more taxpayers' money”**

analyst at Thinkbroadband, said the "perception in the public mind" that Openreach and BT Retail are one and the same leads customers to believe that "signing up with BT Infinity will give a better service". Ferguson noted: "With Openreach totally unlinked from the BT Group this 'relationship' people believe exists will be broken." Now we wait to see if Ofcom believes divorce is best for all concerned, too. ●



# Has Britain hit its broadband targets?

## Beating the "big five" on broadband...

In 2010, the government set a target to have the best broadband in Europe. Shortly thereafter, it tweaked that goal to include only the so-called "big five" countries: the UK, Germany, Spain, France and Italy.

According to a BT-commissioned report from Analysys Mason, Britain has met its goals – now the goalposts have moved. Among the "big five", ranked best for coverage, take-up, second best for price and third for the percentage of fixed broadband with speeds above 10Mbps/sec – now widely considered the acceptable minimum.

1	UK	UK	UK	FR	UK	UK	FR
2	DE	ES	DE	ES	ES	FR	UK
3	ES	DE	ES	UK	DE	DE	IT
4	FR	IT	FR	DE	FR	ES	DE
5	IT	FR	IT	IT	IT	IT	ES
	Superfast coverage	Incumbent superfast coverage	Average measured downstream bandwidth	% of fixed broadband with downstream above 10Mbps/sec	Take-up of superfast broadband	Fixed broadband penetration	Price of broadband connection

European rank	Global rank	Country	Average speed Mbits/sec
1	4	Sweden	16.1
2	5	Switzerland	15.6
3	6	Netherlands	15.2
4	7	Norway	14.3
5	9	Finland	14
6	10	Czech Republic	13.9
7	12	Denmark	12.9
8	13	Romania	12.8
9	17	Belgium	12.4
10	19	UK	11.8
11	22	Ireland	11
12	23	Austria	10.9
13	24	Germany	10.7
14	27	Portugal	10.4
15	28	Slovakia	10.3
16	31	Hungary	10
17	32	Poland	10
18	34	Spain	9.7
19	45	France	7.9
20	54	Italy	6.4

## ...but where we really rank in Europe

Of course, there's more to Europe than the "big five" – how does British broadband compare to the rest of Europe? According to Akamai's quarterly State of the Internet report, being the fastest for average speeds of the "big five" in Europe isn't saying much: the UK sits mid-table, while Germany, Spain, France and Italy are further down the rankings. It's easy to win when you're playing against the worst in the league...

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# IFA 2015: the best tech from Berlin

**alphr.com**  
**BEST OF IFA 2015**

Thousands of products are on show at IFA in Berlin each year – we've toured the exhibition halls to find the devices to watch

**IT MAKES US** tired just thinking about it: the IFA technology show in Berlin has thousands of products scattered across 150,000 square metres of floor space. We sent a trio of writers from *PC Pro* and our sister site Alphr to battle past the other 300,000 attendees to bring you this collection of the five best products unveiled during the week in early September. While they ice their tired feet, cast your eyes over the very best of IFA 2015.

## ■ Best phone: Sony Xperia Z5 Premium

A 4K television is one thing, but a 2,160 x 3,840 resolution on a 5.5in display is just a little insane. Sony's managed to cram 806ppi into the display on its Xperia Z5 Premium, pipping rivals to the title of first 4K smartphone.

"For the first time in a long time, Sony can boast that it's ahead of the smartphone game," noted reviews editor Jonathan Bray. While most of us would struggle to tell the difference between this display and those boasting fewer pixels per inch, the



images are, unsurprisingly, pinprick sharp. Display aside, the new Xperia features a fingerprint reader and, like its predecessors, is water- and dust-resistant. Add in 3GB of RAM, 32GB of storage, a microSD slot and a 23-megapixel camera, and it's easy to see why this is the handset of the show. [pcpro.link/254sonyxpriaz5](http://pcpro.link/254sonyxpriaz5)



**LEFT** The Samsung Gear S2 includes a round face with a rotating bezel for navigation

## ■ Best smartwatch: Samsung Gear S2

Samsung's Tizen OS smartwatches have thusfar only worked with selected phones. Until now. The latest wearable from the tech giant sees the OS open up to Android, working with any recent phone on the Google platform that includes more than 1.5GB of RAM.

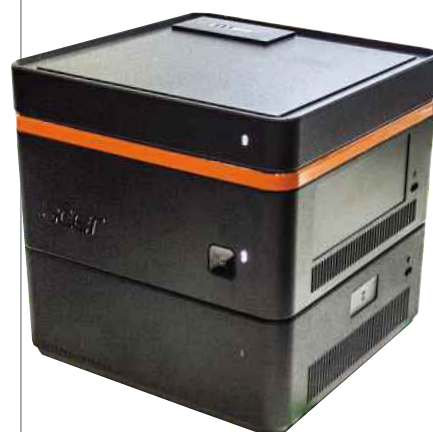
And that's just the software. Samsung has opted for a round watch face with a rotating bezel for navigation, similar to the digital crown on the Apple Watch. It features the usual fitness and health apps, and the 3G version of the watch even lets you order an Uber cab with a tap on your wrist – even if your smartphone is at home.

"The rotating bezel looks like a genuinely good idea, and the quality and finesse of the design may be enough to draw focus away from the increasing number of gorgeous high-end wearables," said Jonathan Bray. [pcpro.link/254samsunggears2](http://pcpro.link/254samsunggears2)

## ■ Best PC: Acer Revo Build

The Revo Build's stackable, modular design makes it easy to upgrade. That

means you can buy the mini PC for £200, then add on extras such as a hard drive, external GPU or speakers simply by stacking them on top of the base, while a discrete connector carries power and data between the blocks. "Imagine if an Intel NUC had an illicit love affair with a box of Lego: their lovechild would surely be the Acer Revo Build M1-601," said Sasha Muller, life and culture editor on Alphr. That's not a sentence we thought we'd ever read in this magazine, but we're pleased to hear creative PC design isn't dead. [pcpro.link/254acerrevobuild](http://pcpro.link/254acerrevobuild)



**RIGHT** The Acer Revo build is like the lovechild of an Intel NUC and a box of Lego

## ■ Best hybrid: Lenovo Miix 700

If Microsoft's Surface Pro 3 appeals to your heart but not your wallet, Lenovo's take on the Windows tablet-cum-laptop might win over both. The Miix 700 looks similar, even sporting a kickstand hinge, but won't put such a dent in your credit limit.

Part of the price difference is due to performance, with the Lenovo version running Intel's Core M chipset rather than the more powerful Core iX chips, but the former should offer longer battery life. "Hopefully with Lenovo now daring to draw cues from Microsoft's school of design, other manufacturers will do so too," said Vaughn Highfield, Alphr.com staff writer, adding: "In time we could see a revolution in hybrid tablets, allowing us to burn hateful and dated clamshell designs and rigid, plastic Bluetooth keyboards in a ritualistic fire." [pcpro.link/254miix700](http://pcpro.link/254miix700)

**LEFT** Sony can finally boast that it's ahead in the smartphone game again



**ABOVE** The Miix 700 steals design cues from Microsoft's Surface

## Best laptop: Lenovo ThinkPad Yoga 260

We didn't only hang about the Lenovo stand, though there certainly was good reason to: our favourite laptop also came via the Chinese manufacturer. As the name suggests, this laptop combines the ThinkPad's business-focused design with the flexible hybrid features of Lenovo's Yoga line, including Intel's Skylake chips, the latest SSD tech, including the NVMe Express (see *What is... NVMe?*, right), and new active stylus technology. "Imagine a ThinkPad X1 Carbon that's had its DNA spliced with a Yoga, and then been hit with a shrink ray for good measure: you're now looking at the ThinkPad Yoga 260," said Muller, adding that it's a "business laptop worth getting excited about". This ThinkPad will, unusually, also come in both black and silver. [pcpro.link/254lyoga260](http://pcpro.link/254lyoga260)



**ABOVE** The Lenovo ThinkPad Yoga 260 has a business-focused design

# What is... NVMe?

**Samsung's 950 Pro SSD quadruples its predecessors' read speeds, thanks to a new interface technology. Here's how it works**

SSDs are set to get even snappier. Samsung unveiled its fastest consumer SSD yet, thanks to a new interface technology called NVMe, which takes full advantage of the combination of NAND flash memory and PCI Express.

**NVMe? It sounds like a terribly named boy band.** It actually stands for Non-Volatile Memory Express, which is a new host controller specification. It's an alternative to the Advanced Host Controller Interface (AHCI) that's used in most SSDs, despite the fact it was originally developed for mechanical hard drives.

Why? It capitalises on the low latency and parallelism of SSDs with PCI Express. AHCI can have one queue for commands, while NVMe can manage 65,000. Plus, it requires only one fetch for command parameters, rather than two in AHCI.

**How fast are we talking?** The 950 Pro boasts sequential read speeds of 2,500MB/sec and write speeds of 1,500MB/sec – which is quadruple the read speeds and triple the write speeds of the 850 Pro. Random reads top 300,000 IOPS (input/output operations per second), while write speeds are 110,000 IOPS. All of that is grand for enterprise workloads, but client PCs will also benefit from performance gains, as they will help extend battery life.

**Are those speeds all down to NVMe?** No, the interface spec is designed for use with PCI Express, so the SSD is also seeing a



**“The 950 Pro boasts sequential read speeds of 2,500MB/sec and write speeds of 1,500MB/sec”**

performance boost as it features a PCI Express 3 rather than a SATA interface.

### What's the downside?

Who mentioned that there's a downside?

Alright, there is one. While NVMe already has wide driver support, that's not true for BIOS support so, depending on the motherboard you have, you won't be booting from an NVMe drive without a firmware update.

### And when is this snappy SSD hitting shelves?

Samsung's 950 Pro SSD arrives in October, with a 256GB version costing \$200 (around £130). UK pricing had yet to be released at the time of going to press. However, the Samsung model can't claim to be the first commercial NVMe SSD – that award goes to Intel, which has released its own version, the 750 Series.

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# PC Probe

## Are ad-blockers killing online advertising?

Websites are having to be savvier about how they make money – and the onslaught of mobile ad blockers isn't helping. **Simon Brew** investigates



Advertising funds the written word online, but that model is at risk as more people turn to ad-blockers. Now, thanks to Apple, blockers are spreading from the struggling PC platform to the thriving mobile world.

With the introduction of iOS 9, Apple is allowing ad-blocker plugins for Safari for the first time. Within hours of the launch of the new OS, ad-blocker apps shot to the top of the charts and they've been there ever since.

That's a body blow for publishers, as advertising on mobile will overtake desktop for the first time this year, according to industry body eMarketer. "It's too early to tell what the effect of the iOS 9 update will be on mobile advertising, both from a spending perspective and a publisher revenue perspective," said Bryan Yeager, an analyst from eMarketer, but he said ad-blocking is now "a concern on both" mobile and desktop.

### ■ Block building

The growth in ad-blocking software was profound, even before Apple relented. PageFair is an anti-ad-block startup with a mission to "protect the future of the free internet". Keeping such vested interest in mind, its annual report claims that UK ad-blocking grew by 82% in the year before June 2015, with 12 million people using blockers in

**ABOVE** As online advertising is blocked, publishers will have to find new methods of making money

the UK. It estimated that ad-blocking is set to cost publishers \$22 billion worldwide during 2015, although you may once again wish to tweak your scepticism radar.

Dr Johnny Ryan, the head of ecosystem at PageFair, said that "users are voting with their browsers, and saying 'no' to intrusive advertising". Those "votes" are likely to increase as younger people are more likely to block. Surveys from the Internet Advertising Bureau (IAB) have reported that among 18- to 24-year-olds, the ad-blocking rate is as high as 35%, compared to the 15% average.

"Users are tolerant to a certain amount of contextually relevant advertising," said Karl Hodge, senior lecturer in journalism at Leeds Beckett University. "But there's a tipping point now with a lot of commercially generated content. With publishers operating within squeezed budgets, this is bound to have a deleterious effect on bottom lines."

The IAB asked people if they realised that, by blocking ads, they were taking money away from the website in question. "Over half the people said no," explained Steve Chester, director of data and industry programmes. "They're not making a connection."

### ■ What's the alternative?

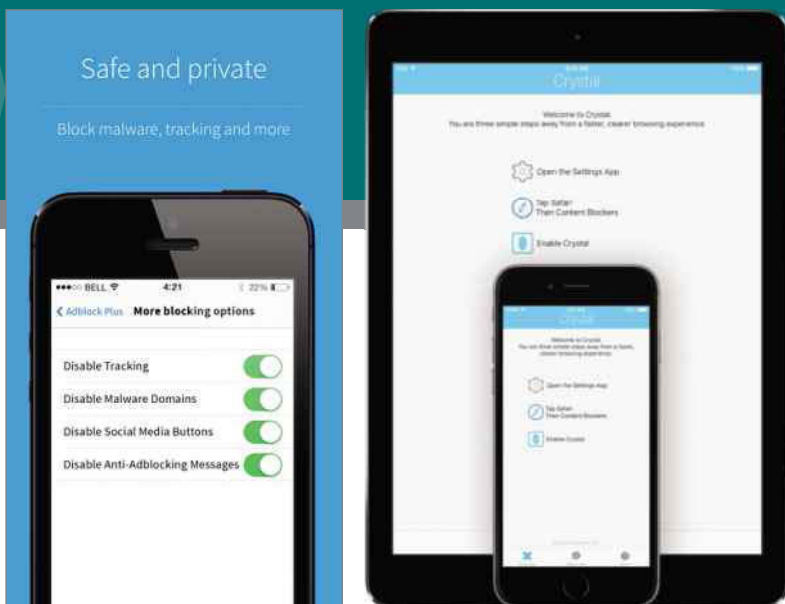
If online advertising continues to wither behind blockers, how else will publishers fund their operations? Well, subscriptions and paywalls are obvious alternatives. For some industries, people will pay for content – Netflix and Spotify prove there's life in subscription models yet – but the written word has had less success. At the start of July, *The Sun* reopened free access to some of its content, after tucking all of its articles behind a paywall in 2013.

Then there's *The Guardian*, which has resisted

paywalled content. A Guardian News & Media spokesperson told *PC Pro* that "we do not see that there is an economic case to put in place a paywall. Instead, we have embraced an 'open' philosophy commercially as well as editorially and are constantly looking for new ways to monetise our journalism."

**“ Ad-blocking grew by 82% in the year before June 2015, with 12 million people using blockers in the UK ”**





Other initiative include micropayments and “tip jars”, while YouTube is setting up a subscription scheme whereby users can pay to remove ads. Yet none of these are likely to fully replace advertising income.

### Life in ads yet?

With ads being forced off browsers, they may simply crop up elsewhere. “The bulk of mobile ad spending, at least in the US, goes toward ads in mobile apps, which are largely unaffected by ad-blocking thus far,” said eMarketer’s Yeager. “More reading of articles in apps rather than on the web is certainly a possibility.”

Either way, ads need to be improved, suggested the IAB’s Chester. “People don’t feel they have choice over what their ad experience looks like, and we need to improve that.” He notes that IAB members stopped using pop-ups in 2006. AdBlock Plus is also trying to reward responsible advertising with its acceptable ads system, which waves through ads that are not deemed intrusive.

Either way, the written word will find a funding model. “As long as there are people interested in learning new things... there will be journalism and – perhaps – an appetite to pay for it in different ways,” Hodge said, noting that “advertising will be part of that mix”.

It’s the rest of that “mix” that publishers are still struggling to find. ●

**ABOVE** iOS 9 lets users block adverts in the Safari web browser

## Is ad-blocking legal – or ethical?

Should you be allowed to block ads? Advocacy groups such as Get Shine argue it’s a human right. It’s not only about irritation, of course. On mobile devices, the bandwidth involved in downloading ads not only slows load times, but eats through data allowances.

On the other hand, that’s the cost you pay for “free” content. Tumblr and Instapaper co-founder Marco Arment made an ad blocker for iOS 9 called Peace, but pulled it within days after it became the best-selling app in the Apple App Store, saying it “just doesn’t feel good” to prevent sites from earning revenue.

Such questions aren’t only for ethical web users, but the courts. Publishers and advertisers last year sued Eyeo GmbH, the creator of AdBlock Plus, in the German courts. The companies behind sites such as Zeit.de and Wiwo.de claimed for injunctive relief,

arguing that AdBlock Plus shouldn’t be allowed to interfere with ads on their websites. The case was dismissed, with the court ruling that Eyeo did not have sufficient market dominance to prevent sufficient numbers of users from seeing ads.

While the blockers won that round, there’s the growing possibility that more publishers will thwart them by other means. Sites can already demand that ad blockers are switched off in order to access material – something Channel 4 already does it for on-demand content. Google accidentally did so via a bug in YouTube, with ad blockers failing to prevent pre-roll ads and removing the “skip advertising” button.

It may have been a bug, but it’s clearly technically possible, and may be one way forward in what’s set to become an advertising arms race.



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# The A-List

The ultimate guide to the very best products on the market today

## LAPTOPS

### Apple MacBook Pro 13in with Retina display

2015 model, from £999

[apple.com/uk](http://apple.com/uk)

With its innovative Force Touch trackpad, Broadwell processors and the same excellent Retina screen, the MacBook Pro is better than ever. It's fast, with superior battery life to the previous generation, and that trackpad improves all-round usability.

**REVIEW:** [pcpro.link/almacp15](http://pcpro.link/almacp15)



## SMARTPHONES

### Samsung Galaxy S6

Android, 32GB, free phone, £26/mth, 24mths

[uswitch.com](http://uswitch.com)

With the Galaxy S6, Samsung has finally created a phone as beautiful as it is capable. Superb performance, a nigh on perfect display and an astonishingly good camera provide the perfect foil to the most attractive Samsung handset yet.

**REVIEW:** [pcpro.link/algals6](http://pcpro.link/algals6)



## ALTERNATIVES

### Asus Zenbook UX303LA

The latest Broadwell Core i7 and a quality screen make this Ultrabook both desirable and great value.

£733; [handtec.co.uk](http://handtec.co.uk)

**REVIEW:** [pcpro.link/alzb303](http://pcpro.link/alzb303)

### Dell Inspiron 15 5558

**NEW ENTRY**

Not the best battery life, but a powerful "do-it-all" Windows 10 laptop that's unbeatable value for money.

£549; [dell.co.uk](http://dell.co.uk)

**REVIEW:** see p80

### HP Stream 11

Good-looking, well built and equipped with a decent display, the petite Stream 11 is as good as it gets for the money.

£179; [hp.co.uk](http://hp.co.uk)

**REVIEW:** [pcpro.link/alh11](http://pcpro.link/alh11)

## ALTERNATIVES

### Motorola Moto G (3rd gen)

The budget smartphone gets a smart new look and an updated camera.

From free, £20/mth

24mths; [uswitch.com](http://uswitch.com)

**REVIEW:** [pcpro.link/almotog](http://pcpro.link/almotog)

### Sony Xperia Z3 Compact

Speedy performance, decent battery life and a fine camera – all for a great price. From free, £21/mth, 24mths;

[uswitch.com](http://uswitch.com) **REVIEW:** [pcpro.link/alsonyZ3](http://pcpro.link/alsonyZ3)

### Apple iPhone 6s

Enthusiasts **NEW ENTRY**

should upgrade for 3D Touch alone, with extra speed and durability as a bonus. 64GB, from £75, £39/mth, 24mths; [uswitch.com](http://uswitch.com) **REVIEW:** see p58

## TABLETS

### Apple iPad Air 2

9.7in tablet, 64GB, £479

[apple.com/uk](http://apple.com/uk)

Even faster, even lighter and just as pretty as ever – the iPad Air 2 takes everything that made the original great and improves upon it. Updated cameras and the arrival of Touch ID are welcome upgrades. Its only real rival is the original 32GB iPad Air, now discounted to a tempting £359.

**REVIEW:** [pcpro.link/alipair](http://pcpro.link/alipair)



## PCs

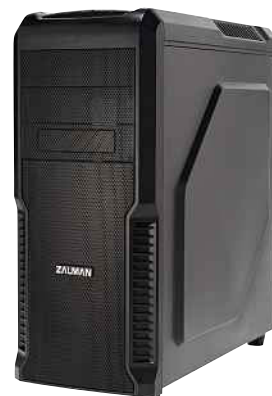
### Chillblast Fusion Quasar

Base unit, £630

[chillblast.com](http://chillblast.com)

Chillblast's Fusion Quasar is the very definition of a classy ultra-affordable compact PC. A Core i5 CPU overclocked to 4.3GHz delivers plenty of raw power, combined with good gaming capability and serious upgrade potential. A five-year warranty seals the deal.

**REVIEW:** [pcpro.link/alchill](http://pcpro.link/alchill)



## ALTERNATIVES

### Samsung Galaxy Tab S2

**NEW ENTRY**

Fast, slim and with a gorgeous 8in display, the Galaxy Tab S2 is as good as compact tablets get.

Expensive, but worth it.

£300; [handtec.co.uk](http://handtec.co.uk)

**REVIEW:** see p67

### Linx 8

Part of a new wave of ultra-affordable compact Windows tablets, the Linx 8 squeezes in plenty for the price.

£100; [currys.co.uk](http://currys.co.uk)

**REVIEW:** [pcpro.link/allinx8](http://pcpro.link/allinx8)

### Sony Xperia Z2 Tablet

The most desirable full-sized Android tablet yet, thanks to great design and battery life.

16GB, £330; [johnlewis.co.uk](http://johnlewis.co.uk)

**REVIEW:** [pcpro.link/alxz2tab](http://pcpro.link/alxz2tab)

## ALTERNATIVES

### Apple iMac 21.5in

A classy all-in-one with a compact frame, ample power and a colour-accurate screen.

From £899; [apple.com/uk](http://apple.com/uk)

**REVIEW:** [pcpro.link/alimac215](http://pcpro.link/alimac215)

### Apple iMac 27in with Retina 5K display

Astonishing image quality and stunning resolution: a great PC.

From £1,599; [apple.com/uk](http://apple.com/uk)

**REVIEW:** [pcpro.link/alimac275k](http://pcpro.link/alimac275k)

### Acer Revo One RL85

An elegant, versatile compact PC with great expansion options and a competitive price.

From £230;

[ebuyer.com](http://ebuyer.com) **REVIEW:** [pcpro.link/alacerrevo](http://pcpro.link/alacerrevo)

## MONITORS

### Asus PB287Q

**Premium monitor, £378**

[ballicom.co.uk](http://ballicom.co.uk)

Not so long ago, a 4K display for less than £500 was unimaginable. Asus delivers exactly that: a razor-sharp image on a 28in panel at a very reasonable price.

**REVIEW:** [pcpro.link/alpb287q](http://pcpro.link/alpb287q)



### Eizo ColorEdge CS240

Eizo ticks almost every box with the 24.1in, 1,920 x 1,200 ColorEdge CS240. With a highly colour-accurate IPS screen, it's the first truly professional-class monitor we've seen at anywhere near this price.

**£462; [wexphotographic.com](http://wexphotographic.com)**

**REVIEW:** [pcpro.link/alcs240](http://pcpro.link/alcs240)

### AOC q2770Pqu

A feature-packed, 27in 2,560 x 1,440 display offering a huge workspace, an adjustable stand, a four-port USB hub and a three-year warranty. Super PLS technology gives great viewing angles too. At this price, it's a steal.

**£310; [dabs.com](http://dabs.com)**

**REVIEW:** [pcpro.link/alq2770](http://pcpro.link/alq2770)

## PRINTERS

### Canon Pixma MG6450

**All-in-one inkjet printer, £113**

[printerbase.co.uk](http://printerbase.co.uk)

The MG6450 inherits its predecessor's status as *PC Pro*'s favourite inkjet all-in-one, offering high-quality output at a very reasonable price.

**REVIEW:** [pcpro.link/almg6450](http://pcpro.link/almg6450)



### Canon Pixma iP8750

Canon's mid-range inkjet is ideal for anyone with a fancy for prints larger than the usual A4. It can print photos at up to A3+ in size, and its six-ink cartridges produce immaculate photographs, yet the price is very reasonable.

**£200; [currys.co.uk](http://currys.co.uk)**

**REVIEW:** [pcpro.link/alip8750](http://pcpro.link/alip8750)

### Epson Expression Photo XP-950

Epson's high-end inkjet all-in-one is a fantastic all-rounder for the enthusiast photographer. It combines high-quality prints with a decent scanner, a great touch interface and the ability to output photos at up to A3 in size.

**£240; [parkcameras.com](http://parkcameras.com)**

**REVIEW:** [pcpro.link/alxp950](http://pcpro.link/alxp950)

## ROUTERS

### Netgear R7500 Nighthawk X4

**AC2350 router, £170**

[currys.co.uk](http://currys.co.uk)

Top Wi-Fi performance close-up and at long range, swift USB NAS performance and all the latest Wi-Fi goodies make the Nighthawk our Wi-Fi router of choice.

**REVIEW:** [pcpro.link/alr7500](http://pcpro.link/alr7500)



### D-Link DIR-868L

This 802.11ac wireless router may not have the most impressive set of features, and it lacks an internal modem. However, in our tests it outpaced models costing twice as much, making it an affordable way to get speedy wireless performance.

**£90; [pcworld.co.uk](http://pcworld.co.uk)**

**REVIEW:** [pcpro.link/aldir868l](http://pcpro.link/aldir868l)

### Netgear Nighthawk AC1900 Extender

The most powerful wireless extender on the market, Netgear's Nighthawk marries five Gigabit networking ports with fast, dual-band 802.11ac support and a host of features.

**£125; [currys.co.uk](http://currys.co.uk)**

**REVIEW:** [pcpro.link/alngex7000](http://pcpro.link/alngex7000)

## HOME NETWORKING

### Synology DiskStation DS215+

**Network-attached storage, £258**

[amazon.co.uk](http://amazon.co.uk) **NEW ENTRY**

A versatile dual-bay NAS with great support for cloud services, dual USB 3 ports and our favourite web-based management interface. It's speedy and packs a lot into a compact unit.

**REVIEW:** [pcpro.link/alds215plus](http://pcpro.link/alds215plus)



### Qnap TS-453mini

Superb performance and a decent range of media and server features – including an HDMI output – make this four-bay NAS drive a great choice for both home and business.

**£418; [dabs.com](http://dabs.com)**

**REVIEW:** [pcpro.link/alts453mini](http://pcpro.link/alts453mini)

### Google Chromecast

This is the future of TV streaming – cheap to buy and simple to use. Plug the Chromecast into a spare HDMI port at the back of your TV, then browse on your smartphone or tablet and beam Full HD content directly to the big screen.

**£30; [play.google.com](http://play.google.com)**

**REVIEW:** [pcpro.link/alccast](http://pcpro.link/alccast)

## WEARABLES

### LG Watch Urbane

**Smartwatch, £174**

[simpleyelectronics.net](http://simpleyelectronics.net)

The best Android smartwatch out there, with a stylish design – including a proper leather strap – a bright circular OLED screen and a 60-hour battery life. It's a great all-round package.

**REVIEW:** [pcpro.link/allgwatch](http://pcpro.link/allgwatch)



### Apple Watch Sport

The slickest smartwatch experience there is, thanks partly to the unique scroll-wheel interface and advanced haptic features. The weakness is battery life – expect to charge it every night – and even the low-end Sport model is a pricey proposition.

**£299; [apple.com/uk](http://apple.com/uk)**

**REVIEW:** [pcpro.link/alapplew](http://pcpro.link/alapplew)

### Pebble Time

A fun, practical watch that works with both Android and iOS. App support is comparatively limited, but all the fundamentals are covered, and the colour e-paper screen helps the Time achieve five days of battery life.

**£180; [firebox.com](http://firebox.com)**

**REVIEW:** [pcpro.link/alpebble](http://pcpro.link/alpebble)



## SECURITY SOFTWARE

### Kaspersky Internet Security 2015

Another year, another excellent performance for this super-secure, lightweight and unintrusive security suite. **3 PCs/1yr, £40; store.pcpro.co.uk**  
**REVIEW:** [pcpro.link/alkasis15](http://pcpro.link/alkasis15)



### Avast Free Antivirus

Still the best free antivirus, although others are catching up. It offers dependable protection – and it doesn't nag you about upgrading. **Free; avast.com**  
**REVIEW:** [pcpro.link/alavast15](http://pcpro.link/alavast15)

### Norton Security 2015

A venerable name in security, Norton provides excellent protection and covers up to five devices, including laptops, tablets and smartphones. **5 devices/1yr, £25; amazon.co.uk**  
**REVIEW:** [pcpro.link/alnort15](http://pcpro.link/alnort15)

## PRODUCTIVITY SOFTWARE

### Microsoft Office 2016 NEW ENTRY

We'll be honest: there's very little here for anyone upgrading from Office 2013. However, this is still the best office suite for professional. **From £110; office.microsoft.com**  
**REVIEW:** see p62



### LibreOffice 5

The interface looks a little dated, and the lack of collaboration features is a shame. But interoperability with Word and Excel is better than ever, making this a fine upgrade. **Free, libreoffice.org**  
**REVIEW:** [pcpro.link/allibre](http://pcpro.link/allibre)

### Scrivener

A brilliant package for serious writers: not only a word processor, but a tool that helps you organise your ideas and manage the process of composition from start to finish. **£28; literatureandlatte.com**  
**REVIEW:** [pcpro.link/alscrivener](http://pcpro.link/alscrivener)

## CREATIVITY SOFTWARE

### Adobe Creative Cloud

The licensing model won't suit everyone, but Adobe's suite of creative tools keeps getting better, covering everything from photo and video editing to web development. **Complete plan, £46/mth; adobe.com**  
**REVIEW:** [pcpro.link/alcc15](http://pcpro.link/alcc15)



### Adobe Photoshop Elements 13

Adobe's home image-editing tool is a terrific and powerful buy, although users of older versions won't find much reason to upgrade. **£50; amazon.co.uk**  
**REVIEW:** [pcpro.link/alelements13](http://pcpro.link/alelements13)

### Steinberg Cubase Pro 8

A big bump in performance and a handful of UI improvements keep Cubase at the top of the audio-production tree. A worthwhile upgrade. **£369; dv247.com**  
**REVIEW:** [pcpro.link/alcubasepro8](http://pcpro.link/alcubasepro8)

## SERVERS

### HP ProLiant DL80 Gen9

Massive storage capacity combines with a high-speed Xeon E5-2600 v3 CPU and a scalable design to push this HP rack server to the top of the tree. The price is very reasonable as well. **£1,026 exc VAT; insight.com**  
**REVIEW:** [pcpro.link/alhpdli80](http://pcpro.link/alhpdli80)



### HP ProLiant ML150 Gen9

HP's compact tower server packs in a huge range of high-end features, alongside impressive expansion capabilities so it can grow as your business does. **£914 exc VAT; insight.com**  
**REVIEW:** [pcpro.link/alhplml150](http://pcpro.link/alhplml150)

## STORAGE APPLIANCES

### Qnap TS-EC880 Pro

Qnap's eight-bay device sets new standards in the desktop NAS appliance space, combining ultra-powerful hardware with every storage feature you could wish for. It has huge expansion potential, and 10GbE networking seals the deal. **Diskless, £1,068 exc VAT; niglohara.com**  
**REVIEW:** [pcpro.link/alec880pro](http://pcpro.link/alec880pro)



### Synology RackStation RS2414RP+

Built with speed and expansion in mind, this 2U rack NAS offers a feast of storage features and plenty of expansion potential. It's good value, too. **Diskless, £1,282 exc VAT; ballicom.co.uk**  
**REVIEW:** [pcpro.link/alrs2414rp](http://pcpro.link/alrs2414rp)

## SECURITY

### Sophos SG 115w

A security appliance that gets it right on almost every level. Easy deployment, a huge range of features and a tempting price make this the perfect choice for SMBs. **With 1yr FullGuard, £809 exc VAT; sophos.com**  
**REVIEW:** [pcpro.link/alsophoss](http://pcpro.link/alsophoss)



### Sophos Cloud

User-based policies and slick mobile support make this a top-class cloud solution. Performance is impressive, too. It's not the cheapest option, but it's a pleasure to use. **10 users, £510/yr exc VAT; sophos.com**  
**REVIEW:** [pcpro.link/alscloud](http://pcpro.link/alscloud)

## BUSINESS PRINTERS

### Epson WorkForce Pro WF-5620DWF

Shatters the myth that inkjets are only for low-demand use, delivering fast output speeds, low running costs and tons of features. It prints at 20 pages per minute, and quality is perfectly acceptable – it can even print glossy photos. **£187 exc VAT; printerland.co.uk**  
**REVIEW:** [pcpro.link/alwf5620](http://pcpro.link/alwf5620)



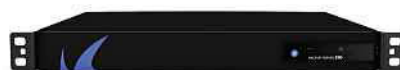
### HP Color LaserJet Enterprise M553x

HP's A4 colour laser offers excellent print quality, fast printing and a low-power fuser that slashes the time to first page. A 10.9in touchscreen display makes it a delight to use too. **£648 exc VAT; printerland.co.uk**  
**REVIEW:** [pcpro.link/alhpm553x](http://pcpro.link/alhpm553x)

## BACKUP

### Barracuda Backup Server 290

A beautifully simple appliance that brings together on-site and cloud backup. There's block-level deduplication, extensive support for Windows systems and applications, integral Exchange MLB, and simple deployment and management. **£4,446 exc VAT; barracuda.com**  
**REVIEW:** [pcpro.link/alserver290](http://pcpro.link/alserver290)



### DataFort Critical Care

DataFort's managed backup service takes care of everything, even bringing up virtual clones of your systems should disaster strike. Per-server pricing makes it cost-effective too. **One server, £350/mth exc VAT; datafort.com**  
**REVIEW:** [pcpro.link/aldatafort](http://pcpro.link/aldatafort)

## NETWORK MANAGEMENT

### Paessler PRTG Network Monitor 15

A network-management solution that's ideal for businesses on a tight budget. Supports a wide range of devices, which are included in the price, and licensing is based purely on sensor count, so there are no hidden costs. An excellent way to keep tabs on what's going on in your network. **500 sensors, 1yr, £1,056 exc VAT; paessler.com**  
**REVIEW:** [pcpro.link/alprtgt15](http://pcpro.link/alprtgt15)



### SolarWinds Orion NPM 11.5

Offers excellent value for money, packing in a huge number of monitoring features as standard, including support for 802.11 wireless access points and virtual machines. **250 elements, £4,110 exc VAT; solarwinds.com**  
**REVIEW:** [pcpro.link/alnpm115](http://pcpro.link/alnpm115)

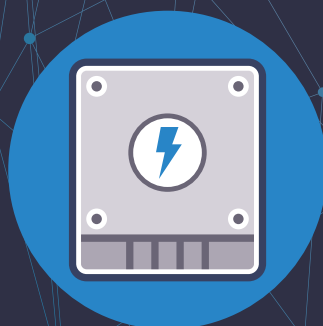


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# Profile

BACKGROUND INFO ON INNOVATIVE BRITISH COMPANIES

## Canonical

There's more to Canonical than a new version of Ubuntu every six months, as **Barry Collins** discovers



### KEY FACTS

#### IN A NUTSHELL

Best known for its Ubuntu operating system, Canonical is a privately held software company founded by the aptly named space tourist Mark Shuttleworth. The company's software powers many cloud computing services, including 70% of Amazon's cloud.

#### FORMED 2004

#### LOCATION

Headquarters in London, with offices in many cities around the world

#### STAFF 700+

#### WEBSITE

canonical.com

**RIGHT** Public perception of Canonical is still focused on the Ubuntu desktop OS

Think Canonical and you'll think Ubuntu – the free operating system that perhaps doesn't get the credit it deserves. Sure, it's barely nibbled at the edges of Windows' market share on the desktop, and it's not even flavour of the month among the Linux community any more, but household names such as Amazon, Netflix and Uber have built their cloud businesses on Ubuntu.

As a result, public perception of the company tends to focus on the desktop OS. "Most people know Ubuntu. They don't know Canonical; they don't know it's a British-headquartered company," admitted Maarten Ectors, the company's vice president of Internet of Things, Proximity Cloud and Next-Gen Networks. He also might be the current world record holder for longest job title, which underlines his point: there's much more going on at Canonical than most people realise.

The big new project at the company is Snappy Ubuntu Core – a slimmed-down rendition of Ubuntu that's not designed for servers or desktop computers, but washing machines, medical equipment, robotic arms, smoke detectors and the gazillion and one other devices that will comprise the Internet of Things. Canonical's charismatic founder, Mark Shuttleworth, describes it as the "smallest, safest Ubuntu ever", while Ectors claims it will allow developers to "put apps in anything".

We asked him to reveal more about life beyond the desktop OS, and what it's like to work in the company's London headquarters.

### ■ Two become one

While Ubuntu's cloud business has been a big success, Canonical cannot truthfully say the same for its phone OS. It failed to convince enough backers to crowdfund its own smartphone, and the OS has only appeared on a very limited selection of third-party handsets. However, even if Ubuntu phones never catch on, the development work hasn't gone to waste. "The two sides of the house that have been contributing to Ubuntu [the desktop/server side, and the phone OS developers] have combined for a third product," explained Ectors.

That third product is Snappy Ubuntu Core. The phone developers have brought their understanding of remotely upgrading operating systems, and

running apps securely by sandboxing them from the main operating system. The cloud team bring their knowledge of packaging applications in "containers" – virtual structures that get only a share of the device's resources, so they can't drag down overall performance, and can be run on virtually any type of hardware.

"We can put apps on anything now," said Ectors. "You can have a robot vacuum cleaner, you can have a fridge, you can have Wi-Fi routers, you could have a stereo, a car, a mobile base station, a tractor, an MRI scanner – anything can have apps, and an app store."

"Most people don't realise what that means," added Ectors, pointing to the disruptive nature of Uber's app, which has seen taxi drivers across the world speak out in protest at their business model being ripped apart by amateur drivers with smartphones. "Imagine now that the capability of apps, which was only contained to one device, can now be transported everywhere. You can put apps on all sorts of devices."

Canonical's vision is that individual devices won't only get smarter, but will gain the ability to integrate with other services. Ectors gave the example of a washing machine with a touchscreen display that could guide a hapless owner through the various wash cycles, using videos streamed over the internet. Devices will also interact seamlessly with one another: the keypad on that same washing machine could, for example, be used to set the burglar alarm. "Somebody comes in, they just tap in the code for the alarm on their washing machine and then they





**RIGHT** Founder Mark Shuttleworth leads an Ubuntu development meeting at Canonical



don't need to have an extra alarm keypad installed next to the door, which comes with the headache of having the batteries changed every year," Ectors said. "Or, you could put a thermostat app on there and basically make the Nest from Google irrelevant."

### ■ Million-dollar apps

Ectors predicts that app stores are about to become much more varied – and expensive. "You'll have apps for your Wi-Fi router at home – £1 apps that come from your telecoms operator, for instance," he said. "For firewall-type equipment, you could buy different kinds of firewalls and load balancers, which might cost hundreds or thousands for an app. And then you might have military equipment or telecom mobile base stations, and there you might have a million-dollar app, because it had to be tested for three years before you could put it in there."

Canonical is, of course, not the only company with skin in this game. Microsoft has so far kept Ubuntu on the sidelines of desktop computing, while Apple and

Android have shoved it to the margins of smartphones. All three have a considerable interest in emerging smart-home and Internet of Things technologies – so what gives Canonical the confidence that it's going to find these markets any easier to crack?

"What we're seeing now is the Internet of Isolated Things," said Ectors. "Your Sonos only talks to

the iPad app that came with it; your smartphone talks with one cloud service, and your Fitbit talks with another cloud service. What we're offering is the possibility to connect your smartwatch to your fridge, and to also put apps on your fridge."

Why would you want apps on your fridge? "Imagine that you want to lose weight. You could then put an app that says: 'Okay, my fridge is locked when I get up in the morning until I stand on my scales.' I'm obliged to stand on them, otherwise my fridge doesn't open. Now comes the moment of truth: do I weigh more than my target weight or less? If I weigh more, the fridge will only open during meal times or when I do exercise and hit my next Fitbit goals."

That kind of interoperability, enabling devices from any manufacturer to work together, simply won't happen

with Apple's gatekeeper approach, according to Ectors. "The Internet of Things is interesting when you can connect everything, not just Apple products," he said. Google, with its more open approach, remains Canonical's "number-one competitor" – but Canonical already has the backing of companies such as Intel and ARM, and in Ectors' words: "If you have more adoption, you make it."

### ■ Problem-solving philosophy

If some of Ectors' ideas sound a tad far-fetched, that's hardly surprising when you consider that the company's founder paid for his own trip to the International Space Station, becoming the first South African ever to enter space. This is a company that encourages people to think big, even if the associated risks are high. "He is a very visionary person," said Ectors of Shuttleworth, who stood down as CEO five years ago to take a more hands-off role. "He will see where the technology is today, understand the problems of the past, and then look at where technology will go tomorrow – and what tomorrow's problems will be."

"If I know that people in three years' time will have a problem, I should start building a solution for that today," he added. He said that Canonical is focused on these "disruptive innovations", but that these come with a high risk of failure compared to evolutionary ideas. "There's nobody you can ask and say 'imagine if you have this problem, will this and this solve it?' It's a problem that's still coming."

This means that employees at Canonical have to be adaptable. Development teams work in squads, focusing on a specific task, but "it might be that there's a change, and something becomes extremely hot and we need to move people from one site to another."

"We've never have anyone leave because they were bored," Ectors added. "We've had people leaving because it was a little bit too much excitement for them. It's not something everybody's fit for." ●

“The Internet of Things is interesting when you can connect everything, not just Apple products”

## What about you?

Do you work for a British technology company that could be profiled in PC Pro? If so, get in touch: [profile@pcpro.co.uk](mailto:profile@pcpro.co.uk)



# Viewpoints

PC Pro readers and experts give their views on the world of technology

## It has never been easy to cheer for Microsoft

**Much has changed in Redmond, but recent faux pas call to mind the Microsoft of old**



**Darien Graham-Smith is PC Pro's deputy editor. He is as old as Microsoft, but likes to think he has made better choices.**

From the day it was announced, I've been hooked on Windows 10. It's not only a great operating system, it's also a great story: the former champion, now deluded and out of shape, suffers one public humiliation too many, regains his old spirit, goes back into training and makes a triumphant

comeback. What could be more compelling than that? Or, you could see it as a drama of personalities: overbearing tycoon Steve Ballmer drives the company to the brink of disaster, before charismatic unknown Satya Nadella steps in to transform the company and save the day.

Alright, I may be romanticising things a little. However, you can't deny that, next to the usual product cycles and boardroom politics, there's something heroic about the image of Windows 10 rising from the wreckage of Windows 8.

That's why it's so disappointing to see Microsoft, with dismal inevitability, derail the narrative with a series of own goals. A few months ago I expressed the hope that the company might relax its policy on automatic updates; instead it's chosen to make them

mandatory. It's a wrong-headed decision that's already left some users with broken systems, after a dodgy graphics driver update was pushed down the line. And this is just the start: the eventual plan, you will recall, is for major OS upgrades to be distributed via the same avenue. What if Microsoft, in its wisdom, decides it's time for another Windows 8-style experiment? This time you'll get it whether you want it or not – and if you don't like it, your only recourse will be to abandon the platform.

Even if you have faith in Microsoft's updates, it sticks in the throat that you're expected to install them without knowing what they do. Three major OS updates so far have all been obliquely trailed as merely "enhancing the functionality of Windows 10", and apparently this is going to be the new norm. It's great that the Feedback app at last gives us an official channel for bug reports and feature requests, but if we don't know what's actually being updated, it's hard to have much faith in the system.

I mentioned above that if you don't like the perpetual merry-go-round of updates, you might have to give up on Windows 10 altogether – but that may be harder than it sounds. As Ian Ray-Todd pointed out in last month's letters page, Windows 10 brings a

**“Next to the usual product cycles, there's something heroic about Windows 10 rising from the wreckage of Windows 8”**

change to the UEFI rules. On Windows 8 devices, Secure Boot could always be turned off, so you could set up a dual-boot configuration or simply replace Windows with another OS. On a Windows 10 device, the OEM may optionally lock down the BIOS, so that your shiny new laptop can only boot an OS that presents Microsoft's cryptographic signature.

That might not sound too offensive, until you realise that one of the systems on the disallowed list is Windows 7. Even though it's officially supported until 2020, and is still Microsoft's most widely used OS by far, the veteran desktop platform predates Secure Boot, and lacks the requisite signature. So if you're unlucky enough to end up with a locked-down laptop, you can forget about your downgrade rights. It's a regressive and unnecessary change: I can't imagine that

it's going to make a significant difference to Microsoft's market share, but it creates uncertainty and frustration for customers.

Then, of course, there's the furore about privacy. I'm not personally bothered about big companies knowing my demographics and browsing habits, but Microsoft really ought to have realised that, in 2015, this isn't something you can take for granted. Wrapping up a big bundle of data-sharing options under the innocent-sounding "Express Settings" rubric was obviously asking for trouble. Similarly, if you think about what Cortana does, it makes sense that it would need to collect information. But Microsoft hasn't been nearly transparent enough about how Windows 10 uses your personal data, and once again customers are left with a sour taste in their mouths.

Are these missteps enough to turn me off Windows 10? Not at all. Provided nothing too offensive comes down through Windows Update, none of it's going to affect the way I use the new OS. Maybe I'm being unfair in even talking about missteps: in the grand scheme of things, perhaps these were the best choices Microsoft was able to make. All the same, they all point in the same unfortunate direction: towards the suspicion

that, beneath the sparkle, Microsoft hasn't really changed all that much; its instincts still tend towards the autocratic and user-ambivalent.

It's hard, therefore, not to feel a little disillusioned. This isn't how the story is supposed to end. The hero isn't supposed to turn out to be just as callous as the bad guy. But then there's always been something

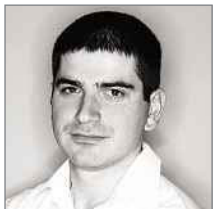
contradictory about Microsoft. As Bill Gates turns 60 this month (see p50), I'm reminded of the debate inside the PC Pro offices, back in 2008, over his legacy as CEO. We ended up printing two different covers to mark his departure from the role: "Farewell and thank you" was the headline on one; "Goodbye and good riddance" ran the other.

And let's not forget the open-ended nature of Windows 10 itself. This isn't a film with a neat denouement, but a rolling soap opera. Without doubt, there will be future storylines in which Microsoft comes out on top, while in others it will probably take a deserved beating. It's the company's ability to switch from hero to villain and back again – and frequently play both roles at once – that, even after all these years, still keeps me eagerly awaiting the next episode.

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# The news Google, Apple et al don't want you to hear

Personalised news, music and TV puts us in a bubble, comforted by own our prejudices



Barry Collins is a former editor of *PC Pro*. Since you ask, he recommends *The Economist*, *Elbow* and *The West Wing*.

Who knows you best? What you think about the government's welfare cuts? Your favourite album? What you like to watch on TV before bed? You might say your partner, but it's almost certainly an algorithm, or at least a combination of algorithms from companies such as

Google, Spotify and Netflix.

Google monitors every link I click on and every search I make so that it can tailor news story recommendations for me via Google Now and News. Spotify creates a playlist for me every Monday, "based both on your own listening as well as what others are playlisting and listening to around the songs you love". Netflix keeps a close eye on my viewing habits to shove suggestions for shows I might like to watch at the top of its homepage, although its algorithm is still a work in progress – it's convinced I'd love *Miranda*, for Pete's sake.

Increasingly, the news and media we consume isn't determined by editors, controllers or schedulers, but by computers. And that trend looks set to continue. Apple, for example, is about to release Apple News, an iPhone and iPad app that "collects all the stories you want to read, from top news sources, based on the topics you're most interested in – so you no longer need to move from app to app to stay informed".

The growth of this personalised, spoon-fed content has alarming implications. First, we have absolutely no idea of how this content is being filtered, selected and presented to us. Most of the news aggregators will use a combination of algorithms and human editors to parse the news, but we

can't be sure if the news stories are being selected for political, commercial or ideological reasons.

Of course, news from any organisation – even dear old Auntie Beeb – is subject to such biases, but we know that the Murdoch press has a particular agenda and *The Guardian* has another, and can make allowances. A scathing story about Jeremy Corbyn in the *Daily Mail* is treated with a little more circumspection than it might be from the *Daily Mirror*.

But who knows the political allegiance of Google or Apple? According to Influence Explorer, Google has donated \$7.3 million to the Democrats since 1989, but only \$2.7 million to the Republicans. Similarly, Apple has given \$1.6 million to the Democrats (including more than half a million dollars to Barack Obama alone), but a mere \$386,000 to the Republicans. Will these political biases play out in the company's News apps? Are stories about Hillary Clinton more likely to appear at the top of Google News in the run-up to next year's presidential election than those about Donald Trump?

Yet more questions are raised when you consider commercial interests. Is Apple News going to risk offending China by publishing stories about, say, anti-Chinese protests in Vietnam or diplomatically tweak its algorithm to ignore them? And let's not forget that Apple and Google don't only cover the news – they are often the news themselves. Are sites that give glowing reviews of the iPhone 6s more likely to top the Tech section of Apple News than those who slate it? We simply don't know, and if you swallow Apple's argument that you no longer need to "move from app to app to stay informed" you may never notice otherwise.

The other big danger of these personalised feeds is that they trap you in a bubble. If, for example, Google Now detects that I don't have much time for the Conservatives, it's less likely to show me news stories about them next time. The Zite app – which uses my social media output and past viewing history to curate content it thinks will interest me – quickly developed a distinct political slant, recommending stories that backed up my political convictions and demoting those that didn't. Whereas the BBC is mandated to give me a balanced diet of political coverage, Google, Zite and others play to my prejudices. This means, like a politician surrounded by a bunch of acolytes, you end up hearing only what you want to hear.

That's literally true when it comes to Spotify. I loved the new Discover Weekly playlist it made for me for the first few weeks. But now it seems Spotify is simply feeding me a diet of REM, The Jam, Turin

Brakes – bands it knows I already listen to. The moment I finished the magnificent *House of Cards*, Netflix was pimping the British version of the same series, along with other political shows. My Netflix homepage is full of boxes telling me to "watch this because I watched that".

There are times, late at night when my brain's on 8% battery, when I love these apps for thinking for me. Sometimes they turn up something surprising and brilliant. Yet, news, music and television shouldn't be homogenised. They should shock, challenge and delight. Beware of the algorithms: they don't know us as well as they think they do.

barry@mediabc.co.uk

# Netbooks aren't dead – they're the best tech available

Forget cutting-edge new features, cheap and cheerful is the best consequence of Moore's law



Nicole Kobie is *PC Pro*'s Briefing and Futures editor. Yes, she is really cheap, why do you ask?

I'm typing this on a netbook. Don't check the date on the spine: you haven't picked up a 2009 copy of *PC Pro*. My favourite hardware is back in my life and it's beautiful – like seeing a long-lost friend for the first time in years.

Throughout my decade covering this industry, my favourite tech remains the netbook. Not the digital camera, which captures so many precious memories; nor my life-in-a-box smartphone; nor even Google Maps, which I'd be literally lost without. The most impressive piece of kit I've ever owned has been a netbook.

My love affair with the netbook started with the first Asus Eee PC. I borrowed the small white laptop and showed it to my friends who, geeks to the core, literally cooed over it. A truly portable laptop, with all-day battery life, for pocket money – or at least not months' worth of savings. And they improved quickly. I covered two years of tech shows with a tiny Acer Aspire that managed 95% of the tasks of my larger, desk-based laptop, but with better battery life and less back strain.

Eventually, however, I found it impossible to replace these mini marvels. Netbooks were dead – killed off by Ultrabooks, Intel's marketing effort to improve laptop design and drive up manufacturers' bottom lines. Most Ultrabooks had all-day battery life, but their gorgeous looks, high-end

“Increasingly, the news and media we consume isn't determined by editors or schedulers, but computers”



components and large displays meant they cost several times the price of a netbook. I wasn't willing to pay for looks, touchscreens, fingerprint scanners or other unnecessary features. And tablets were no good. I wanted a real keyboard, not a flimsy add-on that clips to a screen.

Then, about a year ago, I started working from home. Or, more accurately, from cafés, trains and pubs. My Dell Latitude was a quick and sturdy laptop, but it ate through battery faster than I got through chocolate twist pastries at Caffè Nero. Every time I walked into a café, my eyes were searching for power sockets at ankle height, prompting other customers to complain about the woman with the outrageous foot fetish. I also had to lug the cumbersome charging cable with me. Hardly a lightweight mobile life.

Now, thankfully, the netbook has finally been reborn. My latest purchase is the Asus EeeBook X205TA, and it's the answer to my prayers – and the restraining order from Starbucks. It weighs less than a kilo, boasts epic battery life, is perfectly capable of doing a bit of word processing, browsing, and of playing Spotify – and has a smart red finish. Not bad for £159, and that includes a year on Office 365 Personal.

The EeeBook X205TA's price appealed to me more than the sleek design and HD screens of the more expensive Ultrabooks ever could. Moore's law is not only about processing power doubling every two years, but about costs falling as that process takes place. Cutting-edge tech focuses on the former, but the real magic happens with the latter, when prices fall far enough to give everyone competent devices. The next billion people won't get online with an iPhone, but a cheap Android that has many of the same capabilities for a fraction of the price.

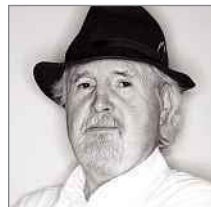
Manufacturers understandably try to swerve the economics of Moore's law, but nobody manages it better than Apple. Look at the latest iPhones. There's a specs update, "rose gold" chassis and "3D Touch" display. None of those are great advances on what went before, but the day Apple stops finding "magical" new features to include in its annual handset refresh is the day that it has to lower the price of the iPhone.

The iPhone 6s may well be one of the best phones on the market, but it highlights just how tech companies dream up swish new features purely to maintain their huge profit margins. Call me when Apple releases a device with a two-day battery life and a waterproof body for half the normal cost, although that would still be more than what I paid for my netbook. Welcome back, my old friend.

 [work@nicolekobie.com](mailto:work@nicolekobie.com)

## Learning to live with the friends you can't stand

**A life without Facebook and Windows has plenty of appeal, but you can dull the pain**



**Dick Pountain edits the Real World Computing section. He wonders whether "unfollowing" on Facebook is rude.**

If you reach my advanced age, you'll discover there are some irritants it's best to learn to live with because they're too much trouble to fix. For me, two of these irritants are Facebook and Windows. I had high hopes for Facebook when it first launched in the UK. In particular,

I hoped it would replace the increasingly cranky CIX as the place where we Real Worlders could meet and exchange copy, but it hasn't worked out that way. We do have a group on Facebook, but it's mostly confined to simple announcements.

Facebook turned out to be less like a senior common room and more like a bustling, screeching market square that drowns out all serious intent. It has the almost magical property of instantly turning everyone into a moraliser or preener, rather than an information provider: "look how well I'm doing", "I defy you not to weep

**“Facebook turned out to be less like a senior common room and more like a bustling, screeching market square”**

over this baby dolphin/kitten/meerkat", "how dare you *blah* this *blah*" and "how many *blahs* have you *blahed*?". It's a conduit for outrage and opinion, rather than fact. This is obvious when you contrast the tone of Facebook comments with those on any proper tech forum: the Ancient Greek philosophers would say it's all about *doxa* (belief) rather than *episteme* (knowledge).

Many's the time my finger hovered over the "Delete account" button, but that impulse passed once I discovered how to switch off people's feeds without offending them by "defriending". I now have friends running into three figures but see only two

figures' worth of posts. I recently realised that Facebook makes a great "*doxa*-meter": post a nascent column idea and see how much flak it attracts (the more the better).

When I mentioned that my Windows 8.1 indexing service had run wild and filled up my entire 500GB hard disk, I received mostly "that's not how you do it" point-scoring. The same thing happened when I posted, ironically, that what I'm hearing about the Windows 10 upgrade process is turning me into an IT "anti-vaxer". Which leads me to my second irritant: Windows 8.1.

You'd never even guess I'm running it by looking at my desktop. The tiles are gone, along with all those hokey apps. My desktop is plastered with icons, some pointing to folders full of vital utilities, while the tools I use most are all on the taskbar, Mac-style. In short, it works well enough to forget about – until a hiccup like a full disk.

Automatic updates are turned off and I pick which ones to install manually, so haven't yet had Windows 10 stuffed onto me. Will I eventually upgrade to 10? Not sure. I worry that my Lenovo is old enough to be in the danger-zone for driver snafus, but a recent article on The Register ([pcpro.link/254register](http://pcpro.link/254register)) also makes me wonder if Windows 10 is intended to tie us into an Adobe-style monthly subscription, software-as-a-service model whereby I lose control over future upgrades.

If that does prove to be the case, I'll definitely defect, not to a Mac as so often recommended by kind friends on Facebook, but to a variety of Linux. You see, I've also come to understand that I actually enjoy wrestling with operating systems: it's a far more fun way to keep my mental muscles exercised than solving word puzzles on a Nintendo Game Boy, while wearing a Pringle cardigan and sitting on the sofa.

I don't object to paying for software per se – I paid for Windows 8.1 in the original cost of my Lenovo – but I do oppose

the ongoing campaign by big software vendors to extend their monopoly status by extracting a rental, rather than sale, price from their customers. This tendency towards rent-seeking runs counter to an opposite tendency of networked digital technologies to make software ever cheaper, even free, thereby

reducing profits (which are needed to pay for research and development, not only to distribute to shareholders).

We're getting into some quite profound questions here. They are the subject of Paul Mason's intriguing book *Postcapitalism*, which I'm currently reading. Mason thinks, as do I, that the fact that digital products can be copied effectively for free tends to undermine the ability to set the rational prices at the heart of current market economics. But that, illuminated by the pure madness that is thank you, is a subject for next month's column.

 [dick@dickpountain.co.uk](mailto:dick@dickpountain.co.uk)

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# Anthony Dang

## .NET developer



### ■ Describe your job

I work for a digital agency called Cogworks. We mostly develop websites and integrations – that is, solutions that sit between a client's system or website and a third-party service. These may include systems to store consumer data, or count the number of times people share a URL on Twitter and Facebook. Our clients range from modelling agencies to insurance companies.

### ■ What tools do you use?

Our staples are Visual Studio and Sublime, since Azure is the main choice for infrastructure. The interface is so much nicer than AWS. And then there's Umbraco, which in my opinion is the best CMS framework. It's open source and has a passionate, fun community. If you'll excuse a bit of self-promotion, Cogworks has just sold out its yearly conference – it's held in London and is called the Umbraco UK Festival.

### ■ How did you get the job?

Back in 2007, I met up with a friend in a pub in Sydney who introduced me to the technical director of an agency called TheFARM Digital. They gave me my first real job, using the Java and C++ I'd learnt at university – although I learned more in my first year of work than I did in my entire computer science degree.

By 2011, I'd moved to London and was attending an Umbraco meetup (again, at a pub). It was there that I met my current employer. I had already made a couple of free Umbraco packages, so I ended up helping them with some websites that were on a tight deadline. Eventually, they offered me a full-time job. If you find your work fun and are good at it, you'll eventually meet the right people. It also helps if you're sociable – although this isn't really something for which developers are really known!

### ■ What are the working conditions like?

At Cogworks, official hours of work are from 9.30am to 5.30pm. Lately we've been experiencing a boom in the number of projects, so there are obviously days when you have to work late. But it all evens out in the end, and our bosses are very appreciative of our hard work. We're even able to work from home – Cogworks has people in London, Manchester, Poland and Colombia, so not being physically in the office isn't a real issue. For other companies, it depends on the culture. I once worked 124 hours in a single week at a company, but you're less likely to be under that sort of pressure in the public sector or at a charity.

### ■ What do you like best about your work?

I love playing around with new technologies and any devices we get. The most interesting one recently was a £30 Wanscam motorised wireless IP webcam. Since Cogworks is geographically distributed, it's good to know if someone is at their desk. We have a few of these little guys around – it's really creepy when they move.

### ■ What's the worst bit of the job?

The higher you go in a digital agency, the more you end up dealing with clients and other third parties. That's what I like least – the politics. But that's part of the game. I appreciate that project managers and account managers have to deal with a lot of that.

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earnings

### ■ What advice would you give to someone wanting to become a .NET developer?

Just jump in and try to make something. Before I started my first job, I didn't know anything about .NET or C#, so I bought myself two books – *Sams Teach Yourself ASP.NET in 24 Hours*, and *Sams Teach Yourself C# in 24 Hours*. I obsessively worked through each chapter, and managed to do it all in three days.

There's definitely a shortage of .NET developers and the framework is quite broad, so you can go in many directions: websites, traditional Windows applications, mobile apps and even server administration. However, if you want to be really good at what you do, you shouldn't just limit your interests to .NET. You should dabble in other languages and technologies, such as Python, Ruby or PHP. The knowledge you gain will help with your day-to-day work, and will make you more employable, since it shows that you have an interest in learning new things.

### ■ What's the pay like?

Developers are privileged to have a skill that is hard for most people, and is in high demand. As a consequence, we get paid more than most other jobs, and should be quite content with that. Working for larger companies will give you more money, but you don't really have much control over processes – I recommend working for a small company. You might take a pay cut, but your job will be far more satisfying, as the decisions you make will actually have an impact on the company. ●

## Where to start

- A good site for beginners is [course.pluralsight.com/learn-dot-net.html](http://course.pluralsight.com/learn-dot-net.html)
- More advanced tutorials can be found at [3schools.com/aspnet](http://3schools.com/aspnet)
- This site can help you begin your career: [microsoftvirtualacademy.com/training-topics/for-beginners](http://microsoftvirtualacademy.com/training-topics/for-beginners)



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# Psst. Here's how to costs while upping

There are easy steps you can take to reduce wastage and create better-looking results

**18%**

WorkForce Pro models are up to 18% quieter than rival laser printers and copiers



There's an easy way for businesses around the country to dramatically reduce waste and energy consumption. To improve the quality of your printouts. What's more, there's a way to take advantage without spending a penny more: most businesses can actually shave money off their monthly costs sheet.

The evidence comes from a new set of independent tests by Buyers Laboratory LLC (BLI) commissioned by Epson. BLI tested several WorkForce Pro models against a selection of competing colour lasers and laser copiers and found that Epson's printers produce up to 95% less waste when printing up to 80,000 pages.

Why? "Laser printers and copiers use a combination of heat and pressure to fuse toner to the paper," explained Paul Steels, Director of Business Image, Epson Europe. "Instead of heat, Epson's inkjet printers use

subtle changes in pressure to fire ink droplets on to the paper, so they consume minimal energy when printing."

At the same time, European businesses could save up to 4.5 days in labour costs per year by switching from laser to inkjet technology. This is based on more independent tests by BLI.

The research found that Epson's WorkForce Pro inkjets are up to three and a half times faster than laser and colour copiers for the first page out. And that they're up to

twice as fast as competitor's inkjets for first page out.

What's more, by switching to Epson's RIPS technology (see opposite), businesses can cut time spent on user interventions by up to 100%

"We don't take count of the lost time people spend waiting for the first page to appear"

compared to colour lasers and copiers on a run of 40,000 prints.

All of this research shouldn't be a shock.

Everyone who works in an office has surely experienced the aggravation of waiting for a short document to emerge from the printer, or needing to replace toner before your page will emerge.

It's easy to think that the simplest answer is to pop down to the nearest PC retailer and invest in new printers. Perhaps shop on Amazon for the one with the highest star rating. But this isn't always the best approach for most businesses.

Instead, you should at the very least investigate managed print services. At a stroke, it means experts in printer efficiency can assess your printer setup and suggest the best way to

**95%**

Epson's WorkForce Pro printers produce 95% less consumable waste when printing up to 80,000 pages



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**100 minutes**

Picking a WorkForce Pro can save up to 100 minutes of worker time on interventions

control costs. It could be drastic – slashing the numbers of printers, perhaps cutting out the personal printers senior executives demand.

There are obvious advantages from an IT perspective. New consumables will arrive when you need them, with no need to build up a stockpile. You'll have predictable costs that you can budget for with confidence. And if something goes wrong with the printer, you don't have to rush to a nearby shop to replace it.

**“New consumables will arrive when you need them, with no need to build up a stockpile”**

But it should also increase the quality of the printouts you produce, reduce wastage and result in happier staff. This is partially because new printers

are so much better suited to a busy office environment than the ones likely to be sitting unloved in the corner. For example, BLI found that WorkForce Pro models are up to 18% faster than competitive laser printers and copiers.

Many modern printers also include features you might only expect to see in large enterprises. One easy way to cut out all those forgotten prints – where people send them to the printer and

then forget to pick them up – is to use a PIN so that the job only starts when they enter it. This is also an effective way to ensure sensitive documents don't sit on the printer, which happens in every office in the land.

The final upgrade is to image quality. Why put up with grainy images when you can benefit from pin-sharp photographs? Why hand out a pitch document with blotchy graphics that undermine your message when you can add to the power of your arguments with a few standout images?

The message is clear. If you've been guilty of ignoring the printers in your office, or replacing them on a piecemeal basis, it's time to take control of the situation. After all, wouldn't you do that if you could genuinely see the time and money being wasted?

**75,000**

The number of pages a WorkForce Pro can print using RIPS technology



## What is RIPS and why you should care

IT staff and employees waste hours fiddling with printer cartridges and waiting around whilst the printer is out of commission. If you buy a WorkForce Pro with Replaceable Ink Pack System (RIPS) technology – available exclusively via a managed print contract – then the problem virtually disappears. The black cartridges last for up to 75,000 pages, while the colour inks keep pounding out the pages up to 50,000 times. The result? A huge number of benefits...

### Stop wasting time

Reduce downtime spent managing and disposing of supplies, walking to central printers, waiting for prints or locating lost or stolen documents. Distribute printers in the most sensible places so your employees can enjoy local, high-quality printing.

### Stop wasting money

Lower the cost of all that wasted time and energy, put IT resources to better use and streamline your supplies management with Epson's RIPS technology. Achieve predictable print costs while reaping the productivity benefits of the distributed print model.

### Stop wasting resources

Four ink supply units, or a mountain of toners, photoconductors, drums and packaging? No contest. Plus, WorkForce Pro RIPS significantly lowers the environmental burden of logistics and recycling to help you meet your environmental targets.





# Readers' comments

Your views and feedback from email and the web

## Windows 10 privacy issues

I read your article about privacy in Windows 10 (see *issue 253, p12*) with interest. Two issues come to mind. First, there are two ways to install Windows 10: Express settings and Custom. If you use Express settings you can later disable some options in the control panel. However, if you compare the services running after an Express installation and a Custom one, Express still leaves some services running reporting back to Microsoft.

Second, consumer PCs are sold with Windows preinstalled. Anyone who requires a PC with no operating system must buy from a supplier, or build it themselves. This negates the whole point of the Express Settings option for most users. No installation media are provided: the most you get is a recovery partition, which will simply reinstall the OS with the same privacy settings. This means the user can't perform a Custom install, and is stuck with whatever settings the manufacturer chose. **Julian Hall**

**Darien Graham-Smith replies:** The good news is that the Custom install option is, for the most part at least, presented when you first boot up a new Windows 8.1 or 10 PC. But I agree, it's not as clear as it ought to be, and users are likely to choose Express Settings without taking the time to fully understand what they're getting into. Microsoft must do better if it wants to be trusted.

## Vodafone software

I have a Vodafone mobile broadband dongle, but the mobile software hasn't worked since I updated to Windows 10 from Windows 7. I have found the install page for the Vodafone app for Windows 8, but the notes say it doesn't work for Windows 10. But, if I just plug the thing in and go to the wireless icon on the taskbar, I can easily connect from there. There's no record of my usage, but that should be available on the Vodafone website.

This raises questions about the people responsible. Why aren't they ready for Windows 10 with their app? Why don't they tell you to get rid of their Mobile Connect software? I've wasted a lot of time. **Peter Bradshaw**

## Downloading 6GB file

I must have missed the memo where Microsoft was given permission to download 6GB of Windows 10 files to my PC without my consent. To make

## Star letter

During the past few weeks, I have had to reboot my laptop four or five times, usually due to Windows or AVG updating. The last two Windows updates have been time-consuming – watching the “installing update x out of n” screen for so long even had me looking online to see if there was a known problem with the update. Now I have another reminder on my desktop that “a computer restart is needed for AVG”.

As a teacher, I usually have numerous folders and documents open as I work, and it's a real pain to remember where I found an interesting resource. So here is my plea to Microsoft, AVG and any other company that needs the whole computer to reboot, rather than just their software. Take a leaf out of

Firefox or Chrome's book, which both manage to reopen all of my tabs after I restart them. If you can't make computer reboots a thing of the past, reopen every Word document, PowerPoint presentation and Explorer window after I reboot, so that everything that I was working on is reinstated. **Tony Fudger**

**Darien Graham-Smith replies:** Microsoft has tried to reduce forced reboots – in Windows 95, you had to restart your PC if you wanted to change your IP address! But I agree, it should be possible to restore applications and documents after a reboot. Perhaps Windows 10 users should open up the Feedback app and start demanding such a feature!

This month's star letter wins a 120GB Samsung 850 Evo SSD worth £53



**ABOVE** If you use the Express Settings, you can disable options in the control panel later

matters worse, if you delete it you need to hack the Registry keys to prevent the damn thing from being downloaded again.

I've read articles on how antivirus vendors try to slip unwanted search bars on your browser when you're updating software, or about mobile phone manufacturers installing unwanted bloatware on handsets. Lenovo was panned for installing an advertising program on its products. But none of this amounted to 6GB. Why does Microsoft think it can download large files onto your machine without your consent?

I'm a Windows 7 user who isn't planning on upgrading to Windows 10, because nothing in life is free. If it quacks like a duck, and swims like a duck, it's a duck. **David Cieszynski**

## Qwertycard complications

I always read Davey Winder's security column with enthusiasm, but the Qwertycard he recommended (see *issue 253, page 118*) overcomplicates the creation of secure passwords. In practice, it seems some methods fit

the human brain better than others. For example, I assume that Google uses six-digit authentication codes because we're used to remembering six-digit numbers (phone numbers) and we can copy them from an SMS to a keyboard with very low error rates. In contrast, hunting out characters on a manual transposition card can be a very slow and error-prone process, as our minds try to flip between original and transposed characters.

There are many better ways to create “secure enough” passwords. For most sites where a compromise would not lose me any money, I use a common “gobbledegook” phrase of six to eight characters (such as “Grooe%q”), and then the first four letters of the site – so “Grooe%qpcpr” for pcpro.co.uk. The gobbledegook part is constant, but has many useful qualities: it contains both numbers and special characters, it's not too long for sites that limit you to 16 characters, and you can always mix it up a little more (say, “pcGrooe%qpr”). The trick is to choose something for which you can easily develop muscle memory, meaning you can type it as instinctively as your own name. Another trick involves using the first letters of words in a phrase: “My Cat Has 5 Kittens! Hear It Purr Loudly” becomes “Mch5k!Hip1”.

True, there is a risk that hackers will wise up to this, and create scripts that look for a website address string, or subsets of it, in a hacked password database. It's a considered risk: first they need to decrypt those passwords from the site, which are often “salted” to make that much harder. Using this technique puts you in the top 0.1% of



the user database, while the other 99.9% use "password1!". The hackers simply won't bother with yours.

The mass-market successor to passwords is likely FIDO, or SQRL, or something similar – using your phone to snap a QR code on a website and log you in without having to press a button. The authentication key changes from something you know to something you have (your phone). And then the game of cat and mouse with the hackers will simply shift up a gear. **Damian Skeeles**

**“Using this technique puts you in the top 0.1% of the user database, while the other 99.9% use ‘password1!’”**

**Davey Winder replies:** The key point is to use whatever method works for you to create and recall complex passwords – that's always the end goal. Your method works equally well, but I'd take issue with it being an inherently "better" way.

**Imitation is the sincerest form...**

The iPad Pro isn't a bad copy of the Microsoft Surface. Although the Surface was introduced after the iPad, it differentiated itself with a snap-on keyboard cover and a stylus, both of which have appeared on the iPad Pro.

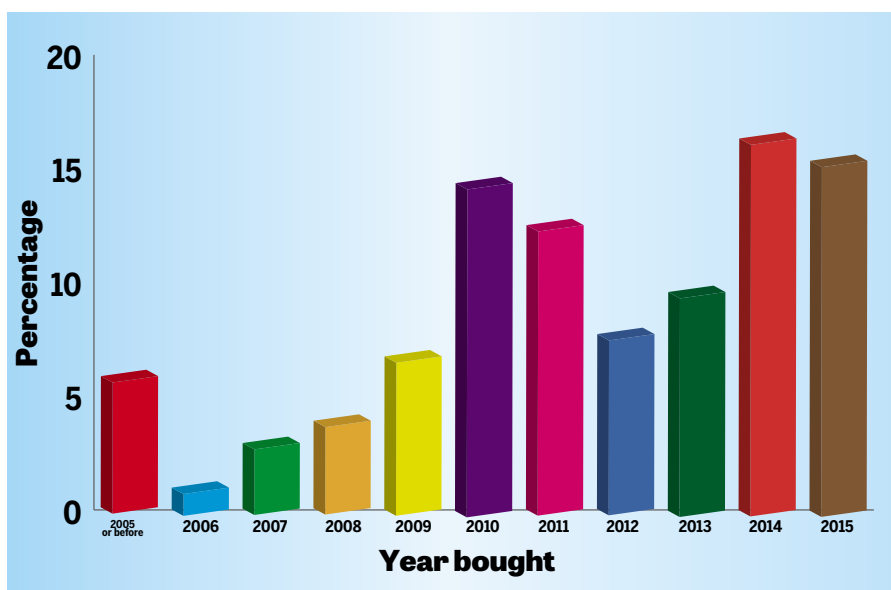
Surely, though, the "app gap" will make it less attractive than Microsoft's original? It's been compared to the Surface Pro, but the hardware is in Surface 3 territory, apart from the display – and this might be a few megapixels too far for the SoC. Maybe Apple should have gone with Intel?

If Apple is copying Microsoft's convertible PC format, what that does to the "PC is dead" meme, which the IT Thought Police have been imposing for the past few years, is anybody's guess. Surely all the really hip dudes are doing it on their iPhones anyway, so this device is unnecessary?

I suspect that none of this will deter the faithful from shelling out for yet another "magical" (if limited) piece of shiny tech from Cupertino. For the uncommitted, I suspect it's neither created nor hit a disruptive market niche in the manner of its forebears. **Wittgenfrog**

## Readers' poll

We asked you: when did you last buy a new laptop?



It looks like there are three sorts of laptop shopper: those who like to stay bang up to date, those who replace their gear only when something better comes along, and finally those who subscribe to the "if it ain't broke" philosophy – including the two respondents who said they'd last bought a new laptop back in 2001.

Major Windows releases in 2006, 2009 and 2012 don't seem to have visibly driven sales, but perhaps that's not too surprising, as a third of respondents said that the last laptop they'd bought had been a MacBook Air or MacBook Pro.

**“I bought a budget Dell in 2010 and it's still going strong – but I'm not sure about upgrading it to Windows 10”**

Bill Dow

**“I'm fed up with Windows; my Asus Chromebook does everything I need”**

Dean Weaver

**“I bought a Samsung netbook just because it was cheap”**

Christian Oliff

**“The Dell XPS 13 was more expensive than others on my shortlist, but I'm delighted with it”**

Zippy

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**TECH**  
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**AWARDS**  
**2015**

Want to know which cloud storage provider or brand of smartphone to pick? We reveal the winners of the UK's biggest IT survey



## LAPTOP AWARD

# Winner: APPLE

## HIGHLY COMMENDED: ACER

For the sixth year running, Apple is the winner of our Laptop award. That's testament to a well-established formula. As C Hart put it: "You get design, function and performance in one package." Another respondent agreed: "They are reliable and have superb support for any queries." Even a glaringly low value-for-money score couldn't keep Apple off the top spot: "You get what you pay for," concluded Omar Nasood.

There was also good news for Acer: having missed out on recognition last year, the Taiwanese manufacturer pipped its neighbour Asus to our Highly Commended award. "I'm on my second Acer laptop," wrote Andrew Pepper. "It's not glamorous, but it works well." Ninety per cent of those who'd bought an Acer laptop this year said they'd happily buy another. "This is the sixth Acer I have bought," wrote Gary Hewit, "and they are always good value for money."

At the other end of the table, Toshiba was criticised for its poor customer service: "It was very difficult to get them engaged when my laptop broke down. I ended up having to purchase an extended warranty," complained Victor Crowhurst.



	Customer support	Reliability	Value for money	Battery life	Overall
Apple	89%	93%	70%	87%	87%
Acer	82%	87%	86%	74%	83%
Asus	77%	85%	86%	76%	82%
HP	77%	84%	81%	74%	80%
Dell	73%	83%	78%	75%	80%
Lenovo	72%	83%	80%	74%	79%
Toshiba	73%	81%	80%	76%	78%

## DESKTOP AWARD

# Winner: CHILLBLAST

## HIGHLY COMMENDED: PC SPECIALIST

When it comes to desktop computing, British PC builders have the market sewn up. Our survey saw Poole-based Chillblast run away with a stellar 97% overall satisfaction score, closely followed by Wakefield's PC Specialist and Bolton-based Scan.

What is it that makes Chillblast such a popular company? A big part is down to their excellent customer service: "I was able to email them and discuss my requirements before buying," noted John Metcalfe. "The couple of little problems I have had they fixed very speedily," added Anna Eklund. "They never quibble when you have a problem –

they're always eager to fix things and try to help you with your problem."

There was also praise for the quality of Chillblast's systems: "I've probably had 20 PCs over the years," said Steven Calton. "The Chillblast is the only one that hasn't missed a beat since the day it arrived."

PC Specialist was another company commended for both its service and quality. "The customer service was great," said Den Pearce. "The website was easy to use, and my order got here a lot sooner than I thought it would. The PC itself works perfectly."

	Customer support	Reliability	Value for money	Speed	Overall
Chillblast	97%	97%	94%	97%	97%
PC Specialist	91%	92%	90%	92%	92%
Scan	80%	83%	78%	83%	81%
HP	75%	85%	79%	75%	81%
Lenovo	74%	85%	84%	74%	80%
Dell	74%	81%	77%	75%	79%



## MONITOR AWARD

# Winner: IIYAMA

## HIGHLY COMMENDED: ASUS

The name Iiyama is almost synonymous with excellence in displays. Jordan Bore described them as "faultless every time". Factor in pricing that's affordable on a home or office budget, and you have a recipe for success.

Meanwhile, Highly Commended winner Asus was praised by fans such as Laszlo Buzasi for the "razor-sharp image and superfast response" of its monitors. Ninety-nine per cent said they'd buy an Asus again, putting it ahead of competitors BenQ (96%) and AOC (95%).



	Image quality	Reliability	Value for money	Overall
Iiyama	95%	95%	92%	95%
Asus	95%	95%	89%	94%
BenQ	94%	95%	91%	94%
AOC	94%	93%	93%	94%
LG	90%	93%	90%	92%
Acer	91%	92%	89%	92%
Dell	92%	92%	86%	92%
Samsung	91%	92%	87%	91%

## NAS DRIVE AWARD

# Winner: SYNOLOGY

## HIGHLY COMMENDED: QNAP

When it comes to NAS, Synology is the clear winner, gaining better scores than its rivals in every area. "My Synology is the best NAS I've ever owned," said Chris Quadling. "It's very reliable, with a drag-and-drop web interface. Its app integration for tablets and phones is amazing too."

However, it's an aggressive market, with stiff competition from Qnap – winners of this year's Highly Commended award. Many respondents praised the company's user interfaces and build quality, with 92% saying they'd buy another Qnap NAS in the future.



	Speed	Reliability	Features	Value for money	Overall
Synology	91%	96%	95%	88%	93%
Qnap	85%	91%	90%	82%	88%
Netgear	75%	82%	78%	83%	82%
D-Link	80%	86%	74%	85%	82%
Western Digital	77%	87%	81%	80%	82%
Seagate	79%	84%	74%	78%	78%

## PRINTER AWARD

# Joint Winners: SAMSUNG & BROTHER

It was impossible to separate our two top-scoring printer manufacturers this year. Samsung had a razor-thin lead on print quality, but Brother just nosed ahead on reliability. One anonymous commenter had nothing but praise for his Samsung: "It's a perfect laser printer, working well on the network and doing the job brilliantly." Daniel Jones, meanwhile, declared: "I only buy Brother printers. The quality of the product is perfect." The only fair conclusion was to name them joint winners.



	Print quality	Reliability	Value for money (including running costs)	Speed	Overall
Samsung	95%	90%	88%	86%	91%
Brother	93%	92%	87%	88%	91%
Canon	92%	89%	82%	79%	87%
Epson	90%	85%	79%	83%	86%
HP	88%	82%	79%	81%	84%

## CAMERA AWARD

# Winner: CANON

## HIGHLY COMMENDED: NIKON

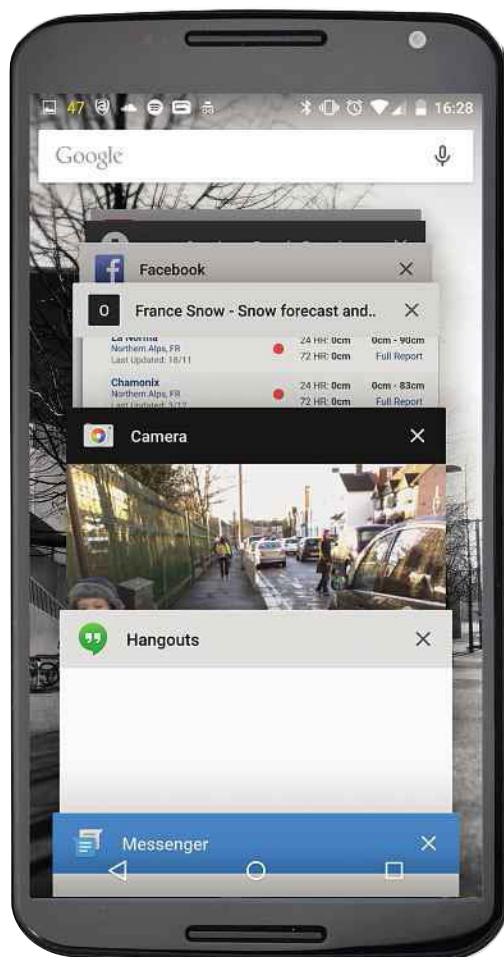
Polling in this category was so close that we were tempted to declare joint winners. Ultimately, Canon nudged ahead to take the title. "Canon seems to get better and better," noted Sean Figgitt. "The sensors improve with each model, and new features such as Wi-Fi are now being introduced."

Rival Nikon fans had plenty of praise for their preferred brand: "You get great compatibility with existing equipment," pointed out L Binns. "Nikon makes you feel like you've joined an exclusive club," added Nick Holmes.



	Image quality	Reliability	Value for money	Video quality	Overall
Canon	96%	95%	88%	85%	92%
Nikon	95%	95%	87%	83%	92%
Panasonic	94%	94%	87%	88%	91%
Samsung	91%	93%	89%	79%	89%
Sony	93%	92%	78%	85%	89%
Fujifilm	89%	90%	86%	81%	88%





## SMARTPHONE AWARD

# Winner: GOOGLE

## HIGHLY COMMENDED: APPLE

Android may be seen as a rather untrendy platform, with the iPhone remaining number one in sales. But that didn't stop Google's Nexus phones from nabbing this year's smartphone award. "With no extra bloatware, Android runs great," explained John Baker. Build quality was another point of praise: "The Google Nexus range might not look like premium devices externally," observed Edmund Paddington, "but the internal components are always first-rate."

However, Apple can console itself with a Highly Commended award, courtesy of the many respondents who preferred its design

philosophy. "Apple is the only answer if you're looking for a smartphone," said Bob Meldrum. "I've tried others, and I always come back to the iPhone." David Wyatt agreed: "I always look for reliability, and this is it."

Our survey also revealed that BlackBerry's customer satisfaction is well below the industry average – a sad result for a once-ubiquitous brand. Meanwhile, Google and Apple both scored very poorly when it came to battery life, as did Android giant Samsung. "I just wish they'd stop making phones thinner, and add bigger batteries instead," lamented one anonymous respondent.

	Battery life	Reliability	Ease of use	Speed	Overall
Google	66%	91%	93%	93%	88%
Apple	69%	89%	93%	88%	86%
Sony	80%	84%	88%	86%	85%
Motorola	78%	86%	86%	79%	84%
HTC	75%	86%	90%	84%	84%
LG	72%	83%	87%	84%	83%
Samsung	66%	83%	87%	82%	82%
Nokia	74%	85%	83%	82%	82%
BlackBerry	80%	74%	62%	65%	69%

## TABLET AWARD

# Winner: APPLE

## HIGHLY COMMENDED: MICROSOFT

Once again, Apple's iPad is confirmed as the tablet of choice. "It's about quality", explained one reader. "Apple has got the software and the hardware perfect." Several survey respondents couldn't resist commenting: "It just works."

Others drew specific comparisons with rival platforms. "I've tried Android tablets in the past, so I thought I'd give Apple a go," said John O'Connor. "I have to say, I was blown away by the speed and battery life." The one recurrent quibble was with the price – but, as with Apple's laptops, most readers recognised that they were paying for quality. "The iPad is pricey, but reliable," concluded Andy Bishop. "It's the top brand

around the world, and rightly so."

The Highly Commended award was close-run: Sony and Lenovo both achieved high satisfaction scores, but didn't attract enough votes to be included in the final count. In the end, the award went to Microsoft, riding high on a wave of praise for its Surface devices. "The Surface Pro 3 finally offers the looks, build quality and performance to compete," reckoned Nick Holmes. Richard Love agreed: "It's great to have a standard USB port and the performance to run full desktop apps." Microsoft is at last becoming a serious tablet player, and it will be interesting to see how Windows 10 helps it build on that success.

	Battery life	Reliability	Ease of use	Speed	Overall
Apple	86%	94%	93%	90%	91%
Microsoft	84%	88%	90%	87%	88%
Samsung	80%	87%	88%	84%	86%
Amazon	80%	90%	89%	84%	85%
Asus	80%	83%	85%	77%	83%



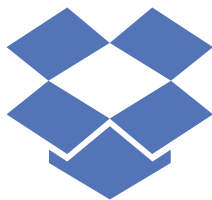


## CLOUD STORAGE AWARD

# Winner: DROPBOX

## HIGHLY COMMENDED: GOOGLE DRIVE

Despite fierce competition in the cloud storage market, the winner's podium remains unchanged from last year: Dropbox romps home in first place, while Google Drive takes a Highly Commended award.

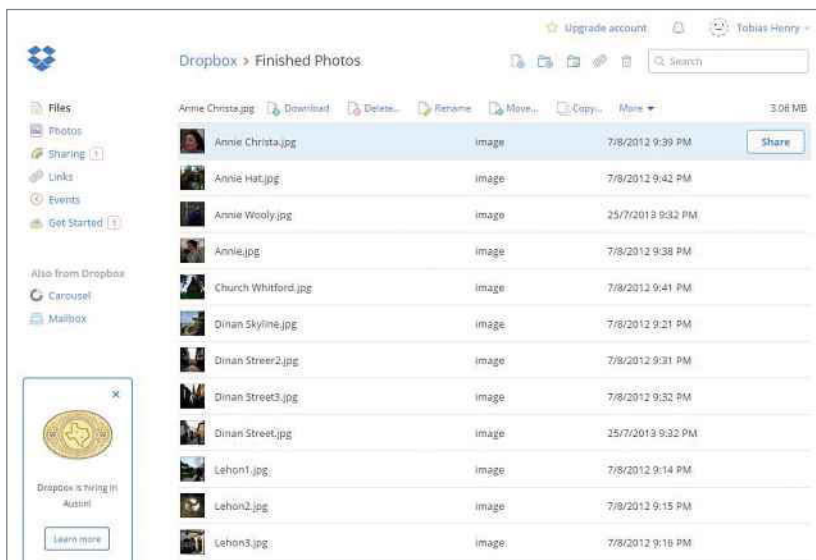


That may come as a surprise because, when it comes to free space, Dropbox is nowhere near the most generous option. Both Google Drive and third-place OneDrive start at 15GB, while Dropbox still starts you off on 2GB of storage (although there are ways to extend that if you're prepared to jump through a few hoops). Clearly, it's Dropbox's ease of use that makes it a winner.

It's also striking how closely the rest of this year's results match those from last year. Overall satisfaction for both OneDrive and Google Drive has stayed at precisely the same mark, as has Apple's iCloud service – perhaps surprising in the wake of its much-publicised security glitches.

We haven't got separate results for Dropbox's business service, so it's hard to compare with Amazon's business-focused S3 platform, but we're a little disappointed to see it near the foot of the table. Notably, it was dragged down by its ease of use score; S3 actually tops the table for speed.

The most disappointing set of figures come from Box. While it's only just off the pace for both speed and ease of use, it surely needs to deliver significantly better results in these areas if it's to win over customers from big-name rivals.



	Speed	Ease of use	Overall
Dropbox	87%	90%	89%
Google Drive	87%	86%	86%
OneDrive	84%	84%	84%
Amazon Cloud Drive	82%	82%	82%
iCloud	81%	80%	80%
Amazon S3	89%	73%	81%
Box	80%	77%	79%

## ONLINE RETAILER

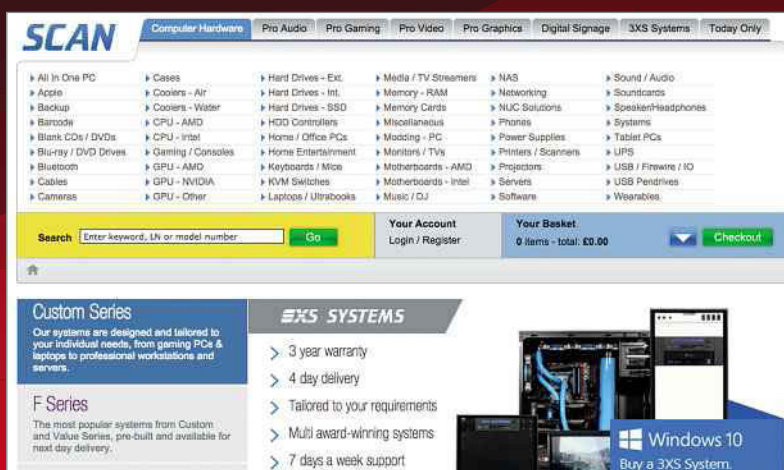
# Winner: SCAN

## HIGHLY COMMENDED: JOHN LEWIS

The online retailer award was hotly contested this year, but PC-maker Scan saw off the competition. One key reason was Scan's quick dispatch: "Scan's one-day delivery is great," reported one voter. "All the items I ordered arrived brilliantly packaged." Another admitted: "I've chosen to pay over the odds for items in the past just because I wanted to order from Scan." As Kevin Tank explained: "Scan can get items to you within 24 hours, even if you order at a weekend or after 5pm."

Former winner John Lewis, meanwhile, achieved a very creditable 93% overall satisfaction score to land this year's Highly Commended award. Again, fast and reliable delivery proved an important deciding factor: "The way John Lewis lets you pick up your order from a store (including branches of Waitrose) is excellent," said David Barker. "John Lewis demonstrates superb attention to customer care," added David Sheerin. "It corrects any issues without a quibble." Consumer ethics

may also have played a role in helping John Lewis beat online giant Amazon. "I buy from Amazon," admitted Donald Mackenzie, "but I don't like them as a company. I feel they are not nice to their employees, suppliers or customers."



Top 10	Customer Service	Delivery	Overall Satisfaction	Overall
Scan	93%	94%	94%	94%
John Lewis	94%	93%	93%	93%
Amazon	90%	90%	91%	91%
Novatech	90%	90%	91%	90%
CCL Online	90%	90%	90%	90%
Overclockers UK	90%	90%	89%	90%
7DayShop	90%	88%	90%	89%
Ebuyer.com	87%	87%	88%	88%
Tesco	85%	86%	85%	85%
Dabs.com	86%	84%	86%	85%

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## MOBILE DATA PROVIDER OF THE YEAR

# Winner: GIFFGAFF

## HIGHLY COMMENDED: TESCO MOBILE

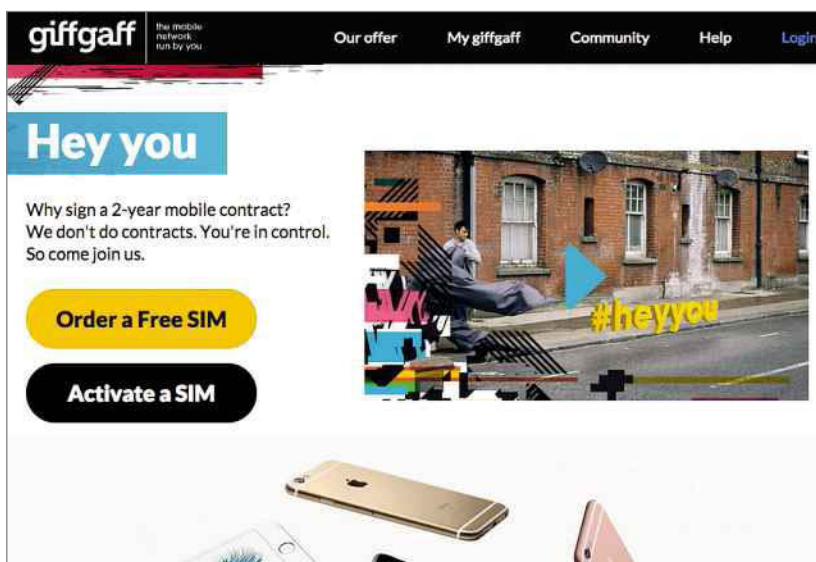
Yet again, big names such as EE and Vodafone have been beaten by virtual networks Giffgaff and Tesco Mobile. Giffgaff, which was Highly Commended last year, takes first place, thanks to its low-cost SIM-only deals.

"It's a brilliant and simple system at a great price," declared Kane Dainton. "I've recommended it to my friends and family, and they've all saved money from joining." Stuart Isenberg agreed: "It's remarkable value for money. I pay £12 a month for 500 minutes, with unlimited texts and 2GB of 4G data."

Last year's winner Tesco Mobile slipped to second place, gaining our Highly Commended award. It might have done better if it wasn't for concerns about 4G coverage on the O2 network, on which it piggybacks. "They advertise 4G, but I rarely get it," complained Shane Moreton.

Unsurprisingly, similar comments were made about O2 itself: "The quality of service varies vastly around England – and this is the 21st century," noted Alan Kidsley. But the real opprobrium was reserved for Vodafone, who finished in last place. "It's an awful network to be with," said Geoffrey Hurst. "They're unhelpful, and their support staff don't speak good English. The internet is very slow, and they charge you for extra data without capping it!"

**giffgaff**



	Reliability	Speed	Customer service	Value for money	Overall
Giffgaff	84%	75%	82%	93%	85%
Tesco Mobile	80%	70%	77%	86%	81%
Three	80%	81%	68%	82%	79%
Virgin Media	80%	72%	71%	78%	76%
O2	76%	72%	71%	65%	72%
EE	74%	74%	61%	62%	70%
T-Mobile	70%	60%	60%	69%	65%
Vodafone	66%	64%	57%	58%	61%

## WEB HOST OF THE YEAR

# Winner: HEART INTERNET

## HIGHLY COMMENDED: 123-REG.CO.UK

A flaky web host can spell big trouble, so a persuasive 92% reliability score saw Heart Internet scoop this year's award. "I've been using them for years, and I really can't complain," said Fazz Khedoo. High scores for speed and value sealed the deal, although some readers noted that support isn't always instant: "When I started using Heart Internet, their customer support was outstanding," recalled Sharon Cowell. "Now you have to submit a ticket for any assistance – but there are still some individuals there who will go the extra mile to help."

Our Highly Commended host 123-reg.co.uk was praised as a good-value option: "Great service and very cheap!" enthused Kieran Hopwood. "Customer support is completely on point too." Other providers achieved decent overall scores, but some readers told of poor experiences: "We have had an appalling lack of response from Fasthosts, after failing to connect to our website on several occasions over the last year," noted Tony Pearson. "It doesn't seem to be possible to talk to anyone, and emails have been ignored."

BT's hosting package was described in even less encouraging terms. "We've had poor customer service, and they're expensive," said one anonymous respondent, while Andrew Rimell wrote the whole service off as "useless".



	Customer support	Reliability	Speed	Value for money	Overall
Heart Internet	81%	92%	88%	83%	86%
123-reg.co.uk	82%	88%	80%	83%	84%
GoDaddy	80%	84%	82%	74%	80%
1&1	70%	83%	79%	76%	77%
Fasthosts	71%	78%	73%	73%	73%
BT	69%	74%	76%	68%	68%



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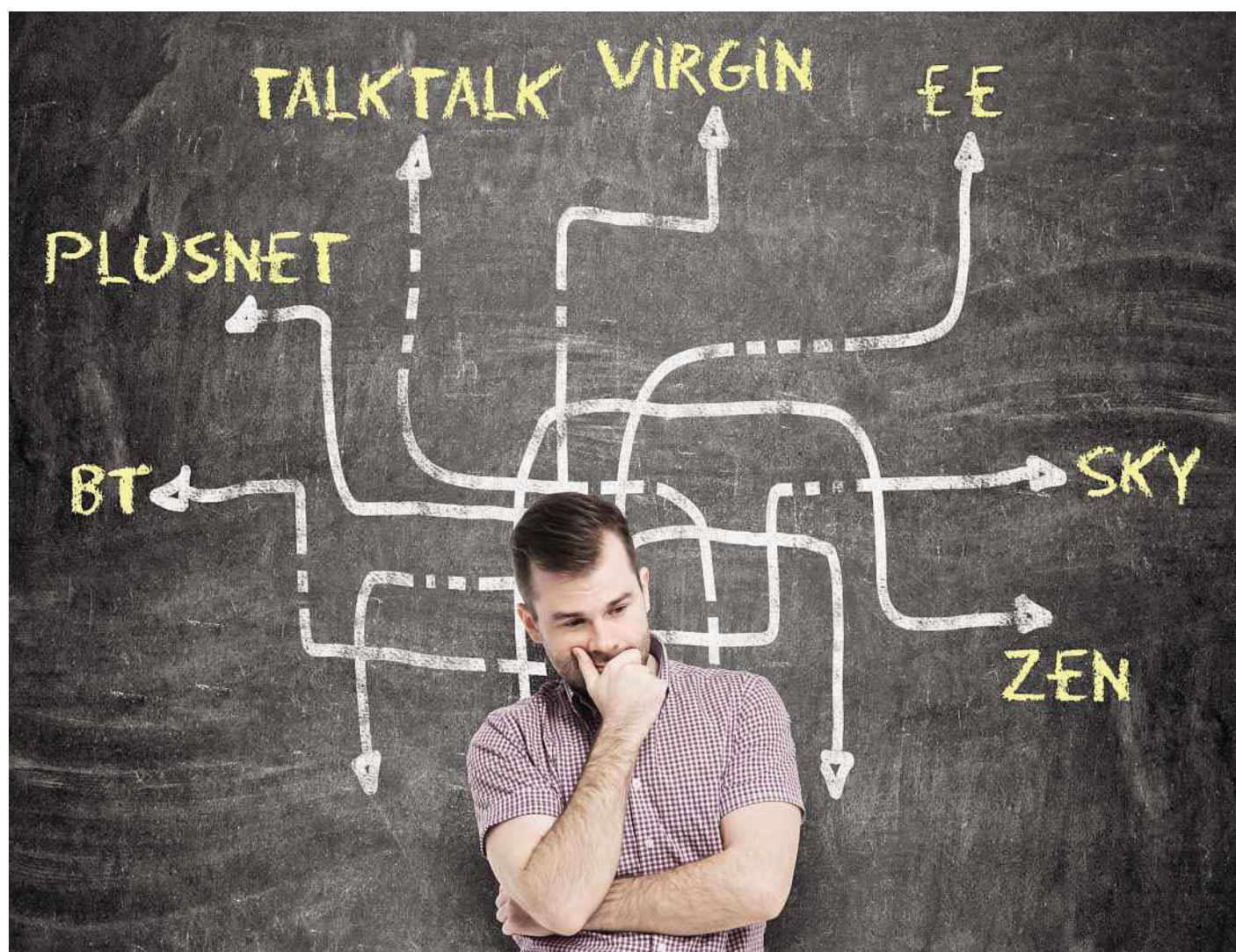
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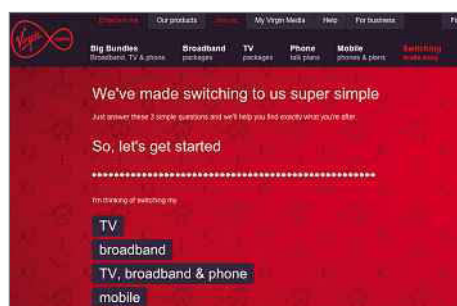
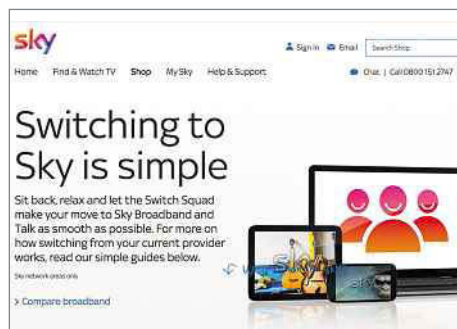
**New rules make it easier to leave your broadband provider behind. Find out how to escape your ISP's handcuffs – and switch to a winner**

**L**eaving your internet provider behind and moving on to another can seem complicated – not least because, these days, your broadband service is often tied up with television, landline and, increasingly, mobile phone services.

But there's good news. If you're able to ditch your contract with your current provider, the process of switching has been simplified by new regulations from Ofcom that came into effect in June.

Previously, when switching from one BT-based provider to another, you were required to obtain a migration authorisation code (MAC) from your current provider before the process could begin. This often involved a tortuous phone call with your provider's customer-service desk, as they spent half an hour trying to persuade you to stay before reluctantly giving you the code. There were numerous reports of providers breaching Ofcom guidelines by refusing to hand it over at all.





**ABOVE** Thanks to Ofcom, the responsibility for switching has been handed to the new provider

Ofcom has now done away with the MAC system. You can simply contact the provider you wish to join and they will handle all the communication with your previous provider – meaning you don't need to ring up your old ISP to cancel. Your old and new ISP will both write to you, confirming the switch is taking place and you have 14 days, to cancel the switch at no charge.

Handing responsibility for switching to new providers makes the migration process much easier, but it opens up the risk of "slamming" – providers poaching customers from rivals without their express permission, which the MAC system was designed to guard against in the first place. The cancellation letter from your current provider should tip you off if an unscrupulous salesperson attempts to slam your line, and Ofcom also demands that the new provider "keep, for a minimum of 12 months, a record of your consent to switch services". That means, if a dispute took place, it should be easy to show that the proper procedure hasn't been followed. Whether or not this safeguard is effective remains to be seen.

If you're switching to or from a Virgin Media cable (or another non-BT provider, such as an independent fibre network), you will still have to contact both old and new providers to initiate what's called a "cease and re-provide" process.

### The bundle lock-in

No matter how easy Ofcom makes the actual switching process, the factor holding many people back from switching their broadband provider is the complexity of their bundle deal. More than six in ten consumers buy at least two of their communications services in a bundle, according to Ofcom's 2015 Communications

## BROADBAND PROVIDER

# Winner: ZEN INTERNET

## HIGHLY COMMENDED: PLUSNET

No company has had a run of unbroken success in the PC Pro Awards like Zen Internet. This is the 12th consecutive year Zen has topped our broadband provider poll, and the Rochdale-based provider's margin of victory is even greater this year than it was last time round.

Customer support and reliability remain the key factors that separate Zen from its peers – exceptional 97% satisfaction scores in both categories shame the competition. "I joined Zen about nine years ago when I read that it was described as 'the most boring ISP' because nothing ever went wrong," wrote one respondent who asked not to be named. "That has proved to be true over the nine years. However, far from being boring, Zen is a fascinating company and the tech support staff are extremely helpful. This is by far the best service I have had from any company – regardless of their product."

If Zen is under pressure, it's from the big providers who bundle broadband for "free" with TV packages. An 85% satisfaction score for value for money is by far Zen's weakest hand, even though it remains an industry-leading score. "Customer support is important, and Zen are very good in this area,"



said Glenn Brett. "But they need to look long and hard at their prices."

As was the case last year, BT-owned Plusnet claimed the Highly Commended award. The company distinguished itself from its parent in every category, most notably customer support and value for money, with Plusnet

offering some of the cheapest ADSL and fibre broadband tariffs on the market – and PC Pro readers claim they can get even better prices from the company if they haggle. "I've been with Plusnet for more than seven years," said Callum Skene. "I found that I can always negotiate a good deal."

"A bit more speed would be appreciated, but I guess you get what you pay for," adds a sanguine Colin Howells, seemingly voicing the thoughts of many respondents – speed was the category in which Plusnet scored most poorly.

EE has seemingly had a year to forget, falling from a mid-table finish in 2014 to bottom of the pile this year, albeit with only a slight drop in overall satisfaction. Yet with an impending takeover from BT merely awaiting the regulator's rubber stamp, EE customers can surely expect to be subsumed into the mothership by this time next year.

Top 7	Customer support	Reliability	Value for money	Speed	Overall
Zen Internet	97%	97%	85%	90%	94%
Plusnet	81%	83%	83%	74%	82%
Virgin Media	71%	80%	67%	86%	78%
Sky	68%	69%	64%	57%	64%
BT	57%	72%	58%	65%	64%
TalkTalk	55%	66%	69%	60%	62%
EE	57%	67%	69%	56%	61%

## "More than six in ten consumers buy at least two of their communications services in a bundle"

Market Report, and it's often difficult to split the individual products. For example, broadband is routinely bundled for "free" as part of Sky satellite subscriptions, making it hard to establish the true cost of the broadband element. Virgin Media and BT also offer similar bundles.

Difficulties arise when different parts of the service are tied to varying contracts.

For example, you might want to switch from Sky to Virgin – but, because you signed a new 12-month television deal to get a new Sky+ box when your old one broke, you now can't cancel the TV part without paying a penalty fee, even though you're technically free to switch broadband.

Indeed, bundles are often deliberately priced to deter customers from switching individual components. Take BT Broadband, for instance. Broadband customers can get the BT Sports channels for £5 per month for as long as they remain in contract. If the contract elapses, or they decide to go elsewhere for their broadband, the cost of BT Sport quadruples to £20 per month. Even if you're not entirely satisfied with your broadband, you might end up sticking with it to save money on the overall package. ➔



## “Providers take advantage of customers by gradually edging up the prices of individual components”

It's a bind that hasn't escaped the notice of Ofcom, which is specifically investigating bundled deals as part of its ongoing Digital Communications Review. The regulator says it's worried that such deals “pose a risk to competition” and is looking at ways of “making services easier to compare”.

### Price creep

With bundled deals discouraging customers from making a switch, providers also take advantage of customers by gradually edging up the prices of individual components, meaning that several seemingly small increases mount into a big overall price hike. One *PC Pro* staffer has seen the price of his bundled broadband, phone and television deal increase by almost 20% in one year, after BT imposed separate price increases for line rental (up £1, and £2 from September), broadband (up £1.65) and BT Sport television channels (up £6).

To discourage this sort of behaviour, Ofcom last year introduced new regulations that gave consumers the right to terminate



**LEFT** Despite Ofcom's efforts, escaping from your contract remains a grey area

contract,” an Ofcom spokesperson told *PC Pro*. “Increases have to have been made to the core subscription charge in order to make a claim of material detriment. If it wasn't made clear in the contract terms you agreed at the point of sale that there would be price increases of a specified amount applied at specified times, then there could potentially be room for a claim of material detriment.”

their contract without penalty, if price increases resulted in “material detriment” to the customer. The devil is in the detail, however: would Ofcom count BT's 20% price rise as sufficiently detrimental to allow the customer to escape the remaining six months on his contract? As ever with the regulator, it's a grey area. “It would depend on your

of ifs, buts and maybes. As with Ofcom's regulations on allowing customers to escape a contract if the ISP fails to deliver the speeds it promised, there's no clear definition of what constitutes a breach of the broadband provider's responsibilities. The handcuffs have, we're afraid to say, barely been loosened.

### ROUTER AWARD

## Winner: DRAYTEK

### HIGHLY COMMENDED: NETGEAR

You can pay for the fastest, most reliable fibre broadband there is, but if your router's not up to snuff, it doesn't matter how good the connection is. The *PC Pro* Excellence Awards have told the same story for many years: the routers supplied by the major ISPs simply aren't up to scratch.

BT's Home Hub and Virgin Media's Super Hub were relatively poorly regarded by our readers, although some of that dissatisfaction may relate to older equipment. Both the Home Hub 5 and the Virgin Media Super Hub 2 have scored highly in our reviews, unlike some of their predecessors.

If you're looking for an alternative, DrayTek is once again the brand to put at the top of your shortlist. No fewer than 96% of DrayTek customers said they would buy a router from the company again, and *PC Pro* readers clearly value the flexibility afforded by the company's equipment, opposed to the comparatively restricted equipment that comes free with the broadband connection. “Not the cheapest, but DrayTek are closer to professional equipment than many manufacturers,” said Charlie Noble.

“I purchased a DrayTek router because the router provided in the bundle from my broadband supplier wasn't capable of maintaining a web link to my security camera system, despite hours of helpdesk negotiation and assurance that it was working,” added Michael Shields. “The DrayTek is very capable and handles quite a high traffic load when my son and grandchildren stay on holiday, along with all their digital technology.”

Netgear swipes the Highly Commended award, despite a photo-finish with Asus, purely

because 95% of the company's customers said they would buy a router from the company again, whereas only 89% of Asus's customers said likewise. Nevertheless, both companies have been given a ringing endorsement.



Top 6	Speed	Range	Reliability	Value for money	Overall
DrayTek	91%	88%	91%	83%	90%
Netgear	89%	83%	87%	80%	87%
Asus	92%	86%	86%	80%	87%
TP-Link	88%	83%	83%	86%	86%
Virgin Media	89%	74%	76%	79%	79%
BT Home Hub	80%	73%	75%	76%	77%

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to create a bezel  
this thin...

...imagine how  
good the rest of  
the monitor is



FlexScan EV2750 – The world's first fully flat  
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# Products of the Year

It's been a phenomenal year for new releases, not only for phones and tablets but in the business world too. Here are the picks from editorial staff and *PC Pro* readers

## LAPTOP OF THE YEAR

### Dell XPS 13



"The Dell XPS 13 is exactly what travelling professionals demand from a laptop," said editor-in-chief Tim Danton. "It's powerful, super-light and unobtrusively stylish – and the superb high-resolution 13in screen provides more than enough room for spreadsheets or viewing two windows side by side. That's why, when it came time to specify my work laptop this year, I chose the XPS 13 over anything else. I don't regret it for a second."

## PHONE OF THE YEAR

### Samsung Galaxy S6

"It's disappointing that Samsung's flagship lacks the memory expansion and removable battery of earlier models," said Jonathan Bray. "But in every other aspect, Samsung's latest effort moves the game forward. It's a stunner to look at, it's thinner and lighter than you could possibly imagine for a smartphone with a 5.1in display, and it's stuffed with great features. It has the best screen on a smartphone in the industry, along with decent battery life – and its camera is the best on any smartphone today, capturing sharp, colourful photos and video, whatever the conditions."



## TABLET OF THE YEAR

### Apple iPad Air 2

"Apple has been setting the pace for consumer tablets for years," noted reviews editor Jonathan Bray, "and the iPad Air 2 is a worthy standard-bearer. It's supremely light and thin – but more impressive than that is the sheer amount of top-quality hardware Apple has squeezed into this achingly slim chassis. The screen is simply stupendous, and it has a fingerprint reader, which makes unlocking the device and purchasing apps quick and easy. It's also still among the fastest tablets on the market, despite getting on for a year old."



## CONVERTIBLE OF THE YEAR

### Microsoft Surface Pro 3



Ian Betteridge, editorial director of Alphr, was forthright in his praise for Microsoft's high-end hybrid. "The old saying that Microsoft takes three goes to get a product right is a cliché – but, in the case of Surface Pro 3, it's true. Switching from widescreen to a more laptop-like 4:3 format, and introducing the innovative hinge capable of working at any angle, has massively improved the usability of last year's Surface Pro 2. Add in good performance, a better Type Cover and the all-important pen and you get the best hybrid there is – full stop."



## ONLINE SERVICE OF THE YEAR

### Slack

"I was going to say that there is a storm coming in collaboration software," observed real-world columnist Steve Cassidy. "But the speed of take-up of Slack, and the secrecy with which users guard its deployment, suggests that the storm is already here. If I were a SharePoint house with frustrated, puzzled users, I'd be looking at Slack with a lot of envy."



## WEARABLE DEVICE OF THE YEAR

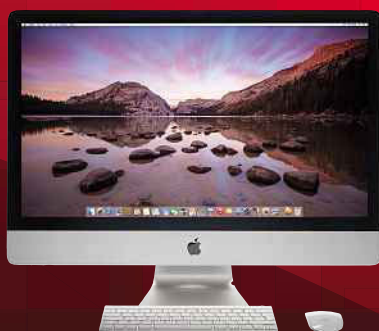
### LG Watch Urbane

"With a stylish design, a sumptuous circular OLED screen, a real leather strap and a full set of features, the LG Watch Urbane is the best advertisement yet for Android Wear," said Darien Graham-Smith. "Its 60-hour battery life makes the Apple Watch look like a toy – and you can pick one up online for under £200."



## WORKSTATION OF THE YEAR

### Apple iMac with Retina 5K display



"High-resolution photo and video editing needs a high-resolution screen with excellent colour performance," noted Jon Honeyball. "This is it – and it has a fast computer bolted on the back, essentially for free. This is the reference point for this sort of work today. Once you have tried it, all else is gaslight."

## MOBILE/TABLET APP OF THE YEAR

### Waze



Navigation app Waze has been around for a few years, but it's lately come into its own as more and more users sign up. "If there's one thing crying out for crowdsourced data, it's navigation," pointed out contributing editor Paul Ockenden. "You get user-generated base maps, road speeds updated in real-time from other users, and live reports of traffic problems, mobile cameras and roadworks. I'd be lost without Waze!"

## SERVER OF THE YEAR

### HP ProLiant DL80 Gen9

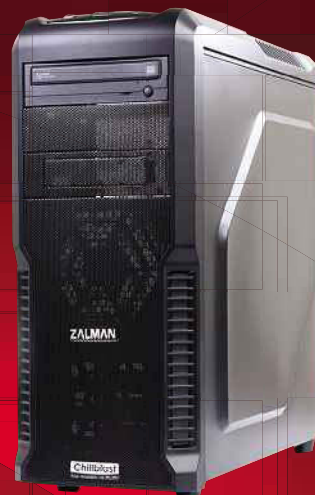


"This budget-friendly rack server doesn't compromise on features," said contributing editor Dave Mitchell. "Its scalable design makes it a great long-term investment for SMBs, the high storage potential is ideal for running storage-centric apps and its Xeon E5-2600 v3 power means it can handle even the most demanding workloads."

## DESKTOP PC OF THE YEAR

### Chillblast Fusion Centurion

"The Fusion Centurion was the first Skylake-based desktop to reach our labs, and it's yet to be bested," recalled deputy editor Darien Graham-Smith. "With its overclocked Core i5-6600K processor delivering a stunning benchmark score of 137, and a set of sparkly new USB Type-C connectors round the back, it's the vanguard of a new generation of desktops."



## SOFTWARE OF THE YEAR

### Adobe Creative Cloud

"When Adobe's creative tools went subscription-only in 2013, I was among those deploring the change," admitted deputy editor Darien Graham-Smith. "But Photoshop, InDesign and Illustrator keep getting better, with this update bringing multiple artboards, new interactive design features and performance improvements – along with the video and web production tools and new stock image library. I still wish you could buy the software outright, but nothing else comes close to the power and breadth of Creative Cloud."



## SECURITY PRODUCT OF THE YEAR

### Sophos Cloud

"There are plenty of good reasons to move your endpoint security into the cloud, and Sophos Cloud is a great way of doing it," said contributing editor Dave Mitchell. "It combines an intuitive and lightning-fast web portal with slick user-based security policies and a quality feature set. Add in support for both servers and desktops, plus the best mobile device controls in town, and it's a compelling package."

# SOPHOS

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- 8GB Corsair 2400MHz DDR4 memory
- Intel HD graphics
- 120GB SSD + 1TB low-noise HDD
- 3 Year Premium Warranty
- Microsoft Windows 7 Home Premium 64-bit

**£1075** Inc VAT



The 3XS TZ170 DAW is our most popular computer music PC. A great all-rounder designed for I.T.B (in the box) production duties with plenty of scope for further expansion, makes it suitable for home and pro studios alike. Sporting a 4.4GHz overclock option with up to 64GB of memory as well as noise management with carefully chosen cooling.



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- Microsoft Windows 7 Pro 64-bit

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The GW-HT20 features the 8-core Intel Core i7 5960X CPU with Hyper-Threading which we overclock to 4GHz. This very powerful CPU is partnered with the high-end 4GB NVIDIA Quadro K4200 graphics card. Also included is 16GB of high bandwidth 2666MHz Corsair DDR4, a 250GB Samsung SSD and 2TB Seagate hard disk.



## Gaming Systems

Scan 3XS Pro Gaming systems are engineered to give you an edge over your competitors in the latest games. Each model has the perfect blend of cutting edge components to help you pwn noobs without having to break into a sweat. Our range includes powerful tower systems, miniature marvels and gaming laptops for all budgets.



### 3XS Z170 Vengeance

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- 8GB Corsair 3000MHz DDR4 memory
- 4GB NVIDIA GeForce GTX 980
- 240GB SSD + 2TB HDD
- 3 Year Premium Warranty
- Microsoft Windows 10 Home

**£1525** Inc VAT



Our highly popular Vengeance gaming system is based around the immensely powerful NVIDIA graphics card, the 4GB GeForce GTX 980. To make that the GTX 980 isn't held back this awesome gaming PC also includes an Intel Core i7 6700K overclocked to 4.6GHz which is accompanied by 8GB of RAM, a 240GB SSD and 2TB hard disk.



### 3XS GW-HTX30

- Two Intel® Xeon® E5 2640 V3
- 32GB Crucial 2133MHz DDR4 ECC
- 4GB NVIDIA Quadro K4200
- 240GB SSD + 2TB HDD
- 3 Year Premium Warranty
- Microsoft Windows 7 Pro 64-bit

**£3699** Inc VAT



The GW-HTX30 marks a giant leap forward in performance thanks to having two 8-core Intel Xeon E5 2640 V3 CPUs. These are partnered with a 4GB NVIDIA Quadro K4200 professional graphics card and 64GB of 1600MHz ECC Registered DDR3 plus a 240GB SSD and 2TB HDD.



### 3XS Graphite LG1520

- Intel® Core™ i7 4720HQ processor
- 15.6" FullHD 1920 x 1080 screen
- 8GB Corsair 1600MHz DDR3 memory
- 3GB NVIDIA GeForce GTX 970M
- 2 Year Premium Warranty
- Microsoft Windows 10 Home

**£1075** Inc VAT



The LG1520 is a 15.6" high-end gaming laptop that includes a choice of powerful NVIDIA GeForce GTX 970M or 980M graphics card, ensuring silky smooth frame rates in all games. The LG1520 is ready for next-day delivery and has a 2 Year Warranty.



Scan 3XS  
Overclocked



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3 Year  
Warranty

**3XS SYSTEMS**



# BILL GATES AT 60



## His ten defining moments



In six remarkable decades, Bill Gates has launched the world's largest software company and saved countless lives. [Ian Betteridge](#) charts his highs and lows



On 28 October 2015, Microsoft founder Bill Gates turns 60. During his life he's been many things: a precocious student, an aggressive founder of a huge company, a super-smart coder and now a philanthropist aiming to rid the world of malaria.

What's been consistent in everything Gates has done, though, is his drive and will to succeed. As a businessperson, Gates looks to the outside world as if he knows no fear, taking on competitors, the US Department of Justice and now a disease.

There have been many moments in Gates' life that have shaped not only his future, but also that of the computer industry. No single person – not even Steve Jobs – has made a bigger impact on computing. Arguably, Gates' work has affected more people than any other person in the 20th century.

We've picked out the ten moments we think encapsulate Bill Gates, both good and bad, and his impact on the world.

## 1975 Gates starts Microsoft

Although they didn't register the trademark until the following year, by the age of 20 Gates and school friend Paul Allen were already running Microsoft – or rather "Micro-Soft", as they were calling it at the time.

The two, who had been friends since school, had been obsessed with computers at a time when they were the size of cars and you worked with them remotely via teletype.

Fortunately, they went to a school that had the funds to install a teletype for computer access – a rarity in the 1960s – although pupils had to pay for computer time over and above their "free" allocation. Allen was so obsessed that, as Gates revealed in a 1995 interview with *Time* magazine, he wasn't allowed to graduate until his parents had paid off the \$200 bill for extra computer time.

Gates and Allen had already started another company before Microsoft, called Traf-O-Data, but it was the opportunity to create a version of BASIC for the Altair 8800 from Micro Instrumentation and Telemetry Systems (MITS), which the magazine *Popular Electronics* described as the "world's first minicomputer kit to rival commercial models", that really spurred their business careers. To sell the product, they needed a company – and Microsoft, without the hyphen, was born.

February 3, 1976  
An Open Letter to Hobbyists

To me, the most critical thing in the hobby market right now is the lack of good software courses, books and software itself. Without good software and an owner who understands programming, a hobby computer is wasted. Will quality software be written for the hobby market?

Almost a year ago, Paul Allen and myself, operating the hobby market to expand, hired Monte Davidoff and developed Altair BASIC. Though the initial work took only two months, the three of us have spent most of the last year documenting, improving and adding features to BASIC. Now we have 4K, 8K, EXTENDED, SORT and DISK BASIC. The value of the computer time we have used exceeds \$40,000.

The feedback we have gotten from the hundreds of people who say they are using BASIC has all been positive. Two surprising things are apparent, however. 1) Most of these "users" never bought BASIC (less than 10% of all Altair owners have bought BASIC), and 2) The amount of royalties we have received from sales to hobbyists makes the time spent of Altair BASIC worth less than \$2 an hour.

Why is this? As the majority of hobbyists must be aware, most of you steal your software. Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid?

Is this fair? One thing you don't do by stealing software is get back at MITS for some problem you may have had. MITS doesn't make money selling software. The royalty paid to us, the manual, the tape and the overhead make it a break-even operation. One thing you do do is prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3-man years into programming, finding all bugs, documenting his product and distribute for free? The fact is, no one besides us has invested a lot of money in hobby software. We have written 6800 BASIC, and are writing 6800 APT and 6800 APL, but there is very little incentive to make this software available to hobbyists. Most directly, the thing you do is theft.

What about the guys who re-sell Altair BASIC, aren't they making money on hobby software? Yes, but those who have been reported to us may lose in the end. They are the ones who give hobbyists a bad name, and should be kicked out of any club meaning they show up at.

I would appreciate letters from any one who wants to pay up, or has a suggestion or comment. Just write me at 1100 Alvarado St, Bldg. Albuquerque, New Mexico, 87108. Nothing would please me more than being able to hire ten programmers and deluge the hobby market with good software.

Bill Gates  
General Partner, Micro-Soft

ABOVE Bill Gates' famous open letter was published in the newsletter of the Homebrew Computer Club

## 1976 Gates sends "the Open Letter to Hobbyists"

Altair BASIC did well, but not well enough for the budding entrepreneurs. At a seminar for the legendary Homebrew Computer Club, a paper tape with the code for Altair BASIC on it disappeared – and at the next meeting, 50 copies of the tape were freely handed out.

This was entirely in accordance with the culture of computing at the time. Code was something you shared, not sold – but Microsoft was receiving a royalty on every copy of BASIC shipped by MITS. And, although MITS was selling hundreds of Altairs per month, only a few tens of copies of BASIC were going along with them.

Appalled by what he saw as the theft of Microsoft code, Gates wrote an open letter to the hobbyist community, which appeared in the Homebrew Computer Club newsletter. He pointed out that "most directly, the thing you do is theft" – setting the tone for the battle between commercial software and piracy that goes on today.

## 1977 Gates gets arrested, and the infamous "mugshot" is born



BELOW Paul Allen and Bill Gates in the early days of "Micro-Soft" and the Altair 8800

If Gates was determined to ensure that computer hobbyists obeyed the law, he was less interested in obeying it himself. Twice, in 1975 and 1977, he was arrested for speeding, although some reports embellish this by adding in driving without a licence and running a stop sign.

The second arrest generated one of the most famous images

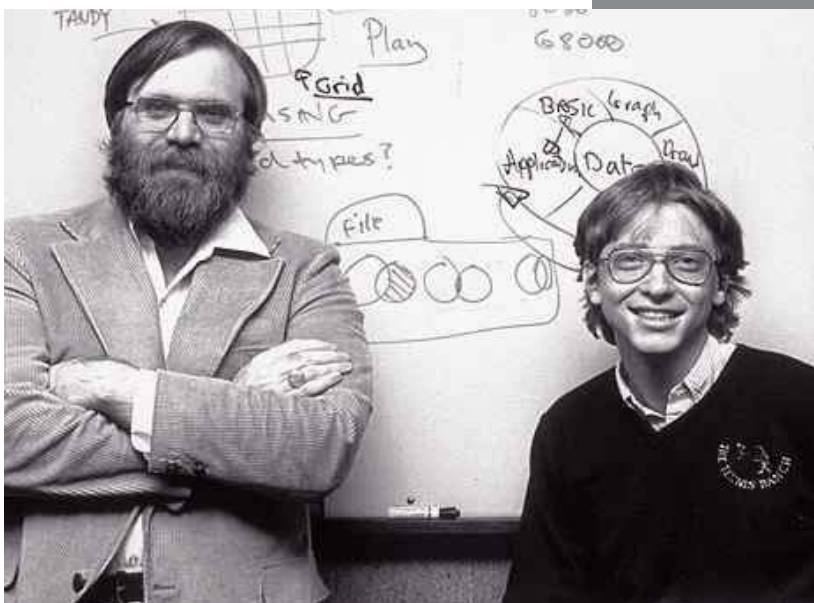
of Gates. Sporting a floral shirt, curious "casual" sweater and a pair of glasses that could only come from the 1970s, the 21-year-old Gates' mugshot makes him look like a teenager, complete with a boyish grin that suggests he really doesn't care about the arrest.

However, the mugshot has had a bigger influence than you might think. Ken Fisher, editor-in-chief of *Ars Technica*, noticed that the default image silhouette used in Outlook 2010 bore a remarkable resemblance to the mugshot. We have no way of verifying this, but the similarities are certainly there to see.

## 1977 Gates officially leaves Harvard

Harvard's student newspaper, *The Harvard Crimson*, once named Bill Gates the university's "most successful dropout", and it's hard to disagree. Gates' record at Harvard was, to say the least, patchy: initially enrolling in 1973, he attended for a few semesters here and there before formally dropping out in 1977, just two semesters short of graduating. He got an honorary degree from the university in 2007, when he told the audience for his speech that "I've been waiting more than 30 years to say this: Dad, I always told you I'd come back and get my degree."

However, Harvard had one important impact on Gates' life: it was where he first met Steve Ballmer, who was to join Microsoft in 1980 and rise to being both Gates' best friend and CEO.





## 1981 Gates, Kildall and MS-DOS

One of the biggest characteristics of Gates' career is his ability to make the most of even the tiniest opportunity, and nothing illustrates this like the deal he made with "Big Blue" to use MS-DOS on the new IBM PC.

The opportunity came when Gary Kildall, founder of Digital Research which owned the then-dominant CP/M operating system, failed to make a deal quickly enough with IBM (the oft-repeated story that Kildall was out flying his personal plane when IBM came calling and refused to land is, sadly, untrue).

Instead, the deal came about when Jack Sams, the lead negotiator at IBM, asked Gates to help find an alternative. Gates, spotting his chance, swiftly made a deal with Seattle Computer Products to license 86-DOS to Microsoft, who in turn reworked it, named it PC-DOS and licensed it to IBM.

## 1983 Gates steals the TV from "their rich neighbour Xerox"

Microsoft started to compete with "Apple Computer" in the early 1980s. Prior to the release of the IBM PC, Apple was one of the largest and most important PC makers in the world, but, by 1983, it had a strange relationship with Microsoft. It wanted to keep Microsoft onside, to get it to develop applications for the upcoming Macintosh, but was also worried that Microsoft would copy the graphical user interface (GUI) for its PC-DOS.

However, Microsoft did the inevitable and announced the first version of Windows. Steve Jobs was furious, saying "get Gates down here immediately!" Gates calmly replied: "I think it's more like we both had this rich neighbour named Xerox and I

broke into his house to steal the TV set and found out that you had already stolen it." Apple had (legally) "borrowed" the GUI concepts from Xerox. In the end, the Windows GUI wasn't very Mac-like, but that didn't stop Apple suing.



## 1997 Gates lends Apple \$150 million

If relations between Apple and Microsoft had started declining in the 1980s, by the mid-90s they were in need of counselling. When Steve Jobs became interim CEO following the departure of Gil Amelio, the company was close to bankruptcy. It needed two things: money, and confidence that Apple had a future.

Jobs called his old sparring partner Gates, and put a potential deal to him: Microsoft would invest in Apple, receiving non-voting stock. In return, the two companies would settle some long-running legal disputes. Gates accepted.

What followed was remarkable. At the summer's Macworld Expo in Boston, Gates appeared on a giant screen to announce the deal. It was a metaphor for where the two companies now found themselves: Microsoft, the giant of the industry; Apple begging scraps. The crowd booed – Jobs told them to "forget the idea that for Apple to win, Microsoft has to lose".



ABOVE Bill Gates made the most of an opportunity with MS-DOS



ABOVE The DoJ deposition shows Gates at his worst – scratchy, irritated and resentful

BELOW Bill Gates appears via video link on a giant screen at 1997's Macworld Expo in Boston and, bottom, with his wife in a publicity shot for the Bill & Melinda Gates Foundation

## 1998 Gates appears before the antitrust trial

The Microsoft antitrust cases brought by the US Department of Justice and the European Commission have probably done more to shape the recent history of the company than anything else. Had Microsoft not had its wings clipped by the DoJ, it could have brought more of its muscle to bear on the mobile market, and made it harder for Android and iOS to gain a foothold.

A turning point in the DoJ case was Gates' appearance before the court to give his deposition. Rather than appearing in person, he gave his testimony via a video link from a Microsoft boardroom. Reports at the time described his testimony as "evasive and unresponsive", with Gates doing his best to pick holes in questions and effectively refuse to answer them.

## 2000 Gates appoints Ballmer his successor

Steve Ballmer had been at Microsoft for 20 years by the time Bill Gates decided to stand down as CEO of the company. He had long been seen as the "prince in waiting", the obvious successor to Gates. It was only really a question of when Gates thought the time was right to step aside.

That moment came in 2000, and it's fair to say that it proved to be one of the less successful decisions in Gates' career. The early years of Ballmer's leadership saw Microsoft at its peak and making more money than it knew what to do with, but it lacked the ability to anticipate the products that would supersede Windows, continuing to bank just on Office and Windows.



## 2000 The Bill & Melinda Gates Foundation launched

For anyone who followed Microsoft and Gates in the 80s and 90s, the biggest surprise in his career is probably endowing most of his money to a charitable foundation. That he also created the foundation with the aim of improving global healthcare, reducing poverty and expanding educational opportunities might have been even more of a shock.

It's a cliché to suggest that Gates' marriage to Melinda French in 1994 brought about a change in his personality. In fact, what probably changed him more was having three children. Coupled to Gates' ferocious intelligence and curiosity about the wider world, it's easy to see how a wider challenge of changing the world might be something he wanted to do.

The Gates Foundation has the largest endowment in the world, with over \$42 billion in funds, and has already seen results. With the help of a vaccination drive, deaths from measles in Africa have fallen by 90%, and the foundation spends more money trying to cure the diseases affecting the world's poorest people than any other organisation. Gates has saved countless lives, and for that we can even forgive him for Windows ME. ●





# SONY



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# Maximise your battery life in Windows 10

**Mike Halsey** explores the tips and tricks to make your laptop or tablet last longer – including several new features introduced in Microsoft's latest OS



When you flick through *PC Pro*, you'll regularly come across exciting new gadgets and technical innovations – but these can come at a high price, in terms of both money and electrical power. For example, today's high-DPI screens may be super-sharp, but they often consume more power than Full HD panels. A lot of work goes into driving down energy consumption – Intel's newest Skylake processors are the company's most efficient yet, thanks to the cutting-edge 14nm manufacturing process and a host of clever energy-saving design tricks. However, no matter how advanced our processors and screens become, or whether or not power-efficient SSD drives and graphics chipsets replace heavyweight spinning disks and graphics cards, our mobile devices remain hamstrung by the inescapable issue of battery life.

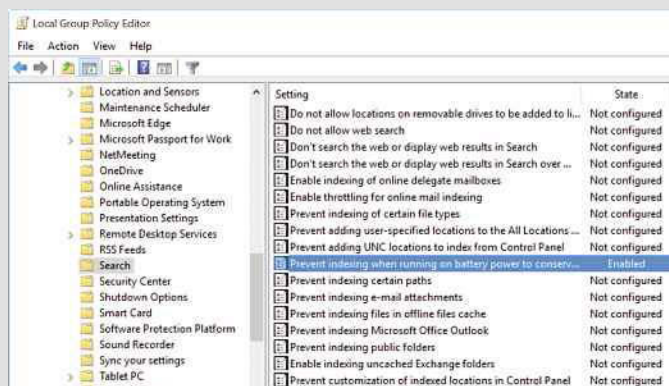
Battery technology hasn't changed much over the past couple of decades. The lithium-ion batteries found in modern laptops and tablets overcame the "memory effect", reducing power drain when a device isn't being used – but we're still waiting for an advance in

technology that will significantly extend the amount of charge that can be stored in a regular cell. Many companies have dedicated research departments tackling this problem, but currently there's nothing on the horizon. This means savings have to be found elsewhere, which is why companies such as Intel are now focusing on power-efficiency far more than processing grunt.

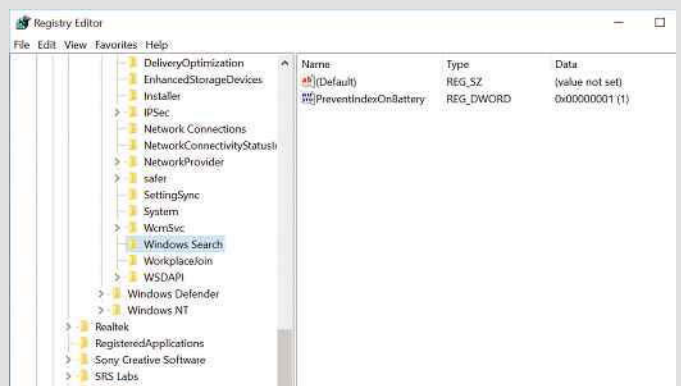
Despite their best efforts, you still need to keep your charger close at hand, even for a brand-new Windows 10 laptop or tablet. But that doesn't mean you should squint at a dim screen, or put your device into flight mode to squeeze as much as possible out of the battery. With careful tweaking and streamlining of your Windows 10 installation, you can boost your battery life by as much as 30%.

We'll look at some of the many ways you can extend the battery life of your Windows 10 laptop, tablet or smartphone – and how you can harness useful features in Microsoft's new OS such as the new battery-saving mode, automatic brightness control and even the new Office Mobile apps.

## Using Group Policy to save power



**1** An easy way to save battery life – especially if your laptop has a mechanical disk – is to disable search indexing when running on battery power, so Windows isn't constantly accessing the disk. If you're using Windows 10 Professional or Enterprise, this is achieved through the Group Policy editor. Open it by searching for "gpedit", and click on the "Edit group policy" link when it appears. Then navigate to Computer Configuration | Administrative Templates | Windows Components | Search. You'll see an option entitled "Prevent indexing when running on battery power to conserve energy" – double-click on this, select Enabled and click OK. You can read about other power policy controls in Windows at [pcpro.link/254power1](http://pcpro.link/254power1).

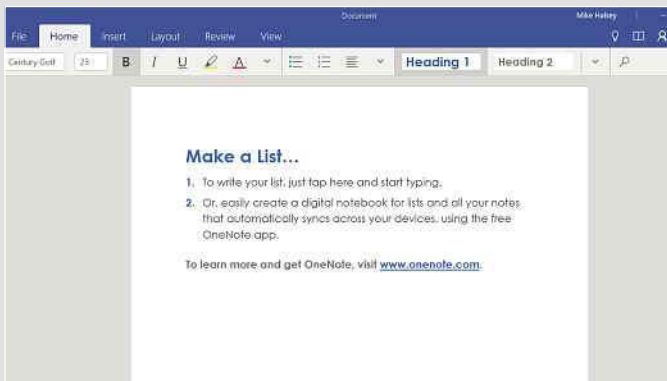


**2** If you're using Windows 10 Home (or a Home Edition of a previous Windows version), you won't have access to the Group Policy editor – but you can activate the same setting by editing the Registry. Needless to say, you should do this only if you're comfortable making this type of change. However, it isn't a difficult process. Search for "regedit" to open the Registry editor, then navigate to HKEY\_LOCAL\_MACHINE\SOFTWARE\Policies\Microsoft\Windows\Windows Search. If you don't see a folder of that name within the Windows folder, create it. Then, in the Windows Search folder, create a new DWORD value called "PreventIndexOnBattery" and give it a value of 1. Restart Windows to make the new setting take effect.

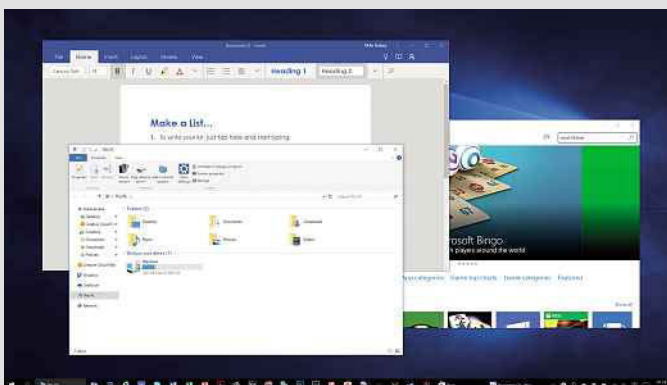
## Six settings to make Windows more power-efficient



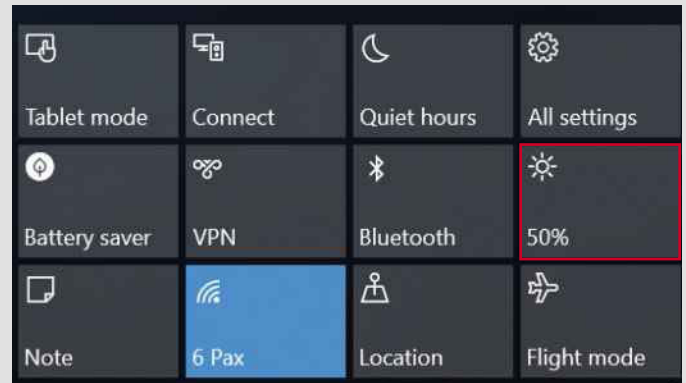
**Set the power button to shut down rather than sleep** Windows 10 starts up in less than 20 seconds, so you can afford to shut it down when it isn't in use. In the Windows Power Options, click "Choose what the power buttons do", and change the "On" battery options for the power button and lid to "Shut down". You can also set your screen to turn off when the device is idle: you'll find this option in the Settings app under Power & sleep.



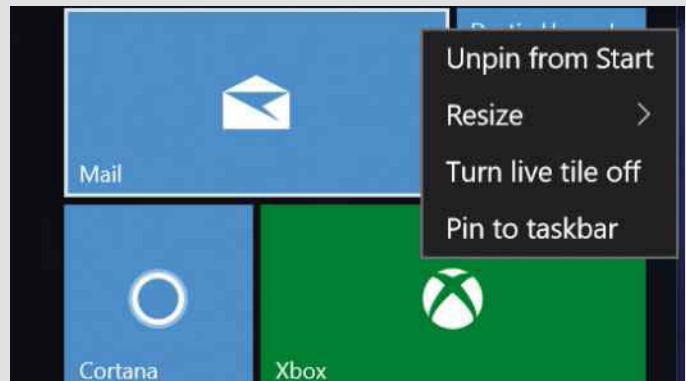
**Use Windows Store apps** Desktop applications use system resources and, therefore, power – even if you're not interacting with them directly. However, Windows Store apps are automatically suspended by the OS when in the background, so they don't eat up the battery. This includes the new Office Mobile apps (Word, Excel and PowerPoint), so switching to them can save considerable battery life, compared to the desktop suite.



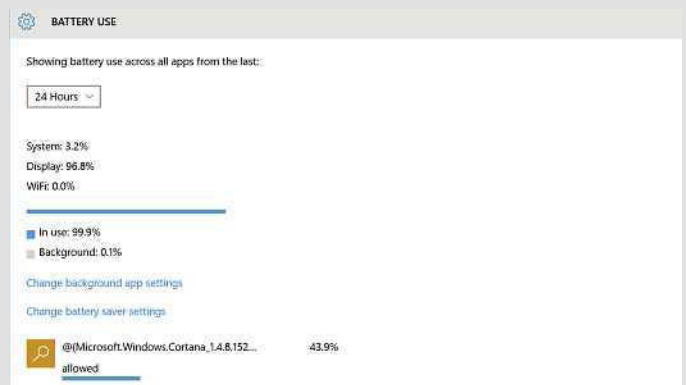
**Run apps in full-screen mode** If you have an app running in a window on the desktop, you're consuming more power than if you were running a single app full-screen. That's because the GPU has to work harder to keep the screen updated. You can save power on your PC by running apps in full-screen mode and switching between them as needed.



**Dim the screen** The Action Centre on any battery-powered Windows 10 device contains a button that allows you to set your screen brightness. Dropping it to 50% can dramatically improve battery life. If your device comes with a light sensor, an Automatic option will be available, which adjusts the setting based on your surroundings: it will use full brightness only when in direct sunlight.



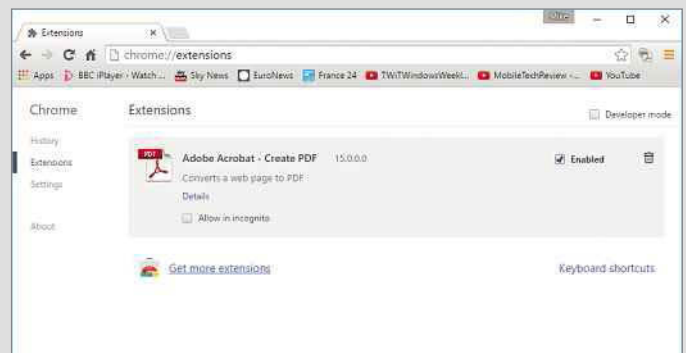
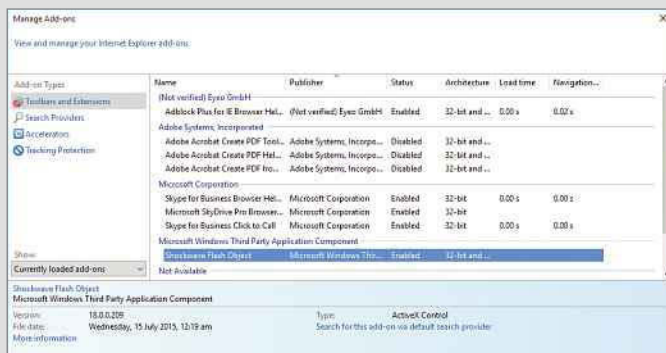
**Disable Live Tiles** On the subject of using Store apps, it's a good idea to turn off any Live Tiles you're not using in the Start menu. You can do this by right-clicking each one, as shown above, and selecting "Turn live tile off" from the menu. Although Tiles use only a small amount of power, it's still worth doing. Ideally, you should disable all Live Tiles: when they're active, Windows 10 occasionally resumes from sleep so they can be updated.



**Manage battery-saver mode and background apps** The battery-saver mode reduces internet and hard disk usage when your battery drops below 20%. You can control it from the Settings app – the "Battery use" link shows you the most power-hungry apps on your system. Click the "Change background app" link to choose which Store apps run in the background.



## Disable web extensions and browse more efficiently



Surfing the web may seem like a fairly simple task – after all, it's just looking at pages, right? – but it can place a heavy load on your battery. Google Chrome, in particular, is a notorious power-hog: running every tab as an independent process is great for stability, but terribly inefficient when it comes to computing resources.

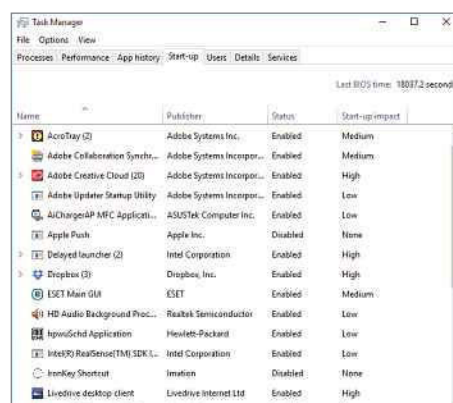
One way to reduce the load is to disable extensions you're not actively using. Microsoft Edge has an advantage here, since it doesn't support extensions at all in its current form – although that capability is coming. It's also a Store app, which means it automatically suspends itself when not in focus.

If you're using Internet Explorer, you can disable extensions by clicking Settings and then "Manage add-ons". Click the add-on you don't want running and then click the Disable button to the bottom-right of the add-ons window. In Chrome, open Settings, then click Extensions in the left panel. Each running extension will have a Disable link to its right. In Firefox, click the application menu at the top-right of the program window and select Add-Ons. Firefox divides these into Extensions, Appearance, Plugins and Services: click each tab in turn, on the left-hand side of the page, to review what's installed, and change the dropdown to "Ask to Activate" for any plugins you don't want to start automatically.

## The startup items and services you don't need

You might be surprised by the number of apps that start up automatically when your PC boots. The culprits can include "Helper Utilities" from Apple, Google and Adobe, as well as bloatware items that come preinstalled on a new PC. These background programs may not individually consume much power, but having lots of them running at once will inevitably take its toll. In Windows 10 (and Windows 8), you can disable unwanted startup items in the Task Manager. Here's how:

- 1 Open the Task Manager by pressing **Shift+Ctrl+Escape** – or right-click a blank area of the Taskbar and select Task Manager from the menu that appears.
- 2 If you don't see a series of tabs along the top of the Task Manager window, click the "More details" button in the bottom left to make it visible.
- 3 Select the Startup tab: you'll now see a long list of startup items, along with a "Start-up impact" rating for each one. Items rated "High" hog your CPU and hard disk when they start up, but that doesn't necessarily translate to battery life: any process can wear down your battery by constantly grinding away in the background.
- 4 To disable a startup app, click its name to select it, then click the Disable button in the bottom-right of the Task Manager window. Be bold: it's extremely rare that disabling a startup item will cause a program to stop working, and you can always re-enable things later if necessary.

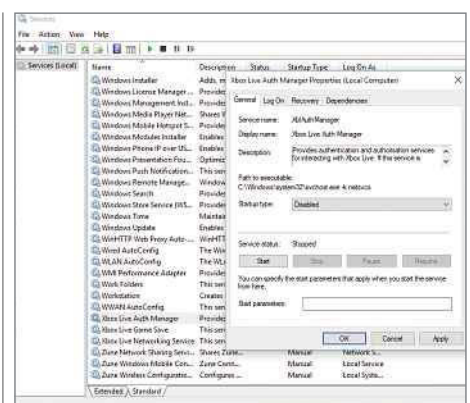


It isn't only third-party applications that run at startup: Windows itself loads up dozens of background services, not all of which you need. Again, disabling these easy:

- 1 Search for services.
- 2 Right-click a service you want to disable and select Properties.
- 3 Change its "Startup type" to Disabled.

Of course, disabling services can cause Windows features to stop working: on a work PC, it might be a bad idea to disable the BitLocker or Remote Desktop services. On a personal laptop or tablet, however, you might choose to do just that.

Other services you may want to disable include the Windows HomeGroup



Listener and Provider services; the Encrypting File System; bluetooth hands-free and support services; the file history; geolocation; Hyper-V; storage spaces; sensor services and the various Xbox services.

If you're unsure about disabling a service, try setting its startup type to Manual. This means it won't be started automatically when Windows boots, but will be enabled if Windows needs it.



Mike Halsey is the author of more than a dozen books about Microsoft Windows and Windows Troubleshooting, including the new *Beginning Windows 10*. You can follow him on Twitter @PCsupportTV



# IMAGE TRANSFER...MADE SIMPLE



## TMT/OKI C711WT

With the ability to print in Colour with White the TMT/OKI C711WT makes printing on surfaces - regardless of colour as easy as 1-2-3.

**1**

**WoW 7.8**

For printing dark garments and textiles in full colour.

A dark blue t-shirt with a colorful graphic print and a blue bag with a 'CLASS OF 14' print.

**2**

**TTC 3.1**

For printing white or pastel garments and textiles.

A white t-shirt with a colorful graphic print and a brown paper bag with a 'THE SPA AT ALNWICK' print.

**3**

**CPM 6.2**

For printing hard surfaces such as leather, metal, glass, ceramic, and PU products.

A collection of items including a framed print, a blue mug with a Twitter logo, a black notebook, and a green glass bottle, all featuring printed designs.

For more information on any of our products please contact us.



**Call Sales on +44 (0)1582 671444**  
**[sales@themagictouch.co.uk](mailto:sales@themagictouch.co.uk)**



# Reviews

The biggest, best, most exciting products in tech – tested, evaluated and reviewed



## Apple iPhone 6s

Apple's new iPhone brings it back to the forefront of mobile hardware – but at some cost

**SCORE** ★★★★★

**PRICE** 16GB, £539 inc VAT; 64GB, £619; 128GB, £699; from £125 on a £39/mth, 24mth contract

You know the script. Apple releases an “s” upgrade to its flagship phone, with a faster chip, a few more features, and

a better camera. Apple fanboys upgrade; everyone else releases a sigh. Well, the iPhone 6s is something bigger. It represents the biggest leap forward for smartphones since the very first iPhone back in 2007.

### ■ 3D Touch takes a bow

The reason for this is 3D Touch, Apple's new take on touchscreen interaction. Put simply, the iPhone 6s

is designed to respond not only to where and how long you press the screen, but how hard you do it. In effect, Apple is attempting to sense “intent” to draw users into an entirely intuitive action.

It's the sort of intention that's at the heart of all good interface and hardware design – the thing Apple has made a habit of executing successfully over the years – and 3D Touch pulls off



exactly the same trick. The pressure-sensitive layer, coupled with a network of sensors behind the 6s' slightly pliable glass, can measure the distance between the glass and the LCD beneath with pinpoint accuracy. That means it not only senses that you're pressing the screen, but also how hard you're applying pressure.

In its most basic form, 3D Touch effectively adds right-click capability. Press the icon of a compatible app on the homescreen a little harder than usual and up pops a context-sensitive menu, offering options and shortcuts related to the app in question. The camera app gives you Selfie, Video, Slo-mo and Take Photo shortcuts; Safari offers up links to your reading list, bookmarks, as well as standard and private tab creation.

There are more sophisticated actions than this, though. Press the screen once – on a web link, for instance – and a preview of the web page appears. Slide your finger up and extra options for sharing and saving appear. Press harder and you pop off to somewhere else in the OS – Safari in this case. Apple calls these preview-then-launch behaviours “peek” and “pop”, and I soon found myself taking them for granted.

3D Touch is implemented in many places across iOS 9. It can be used in the email app to take a quick look at messages without leaving the list view, to view the new Live element of your photos (more on this later), and on the keyboard, where you can press then drag to reposition the cursor. In the Notes app, you can sketch with your finger and push harder for a heavier stroke.

From a hardware perspective, 3D Touch is beautifully implemented.

You don't have to press too hard to activate the first level of pressure sensitivity, and the new Taptic Engine provides a tickle of feedback every time you reach a pressure threshold.

It's the sort of leap forward that may well transform the way we all use our phones in the future, much like the pinch-to-zoom and swipe-to-scroll gestures have. Admittedly, 3D Touch doesn't feel quite finished, with inconsistencies in the way it has been implemented, but that will change over time as app and (most excitingly) game developers get hold of the technology and try out new ideas. For now, 3D Touch only works with select Apple software and apps.

## ■ Cameras

The other major change on the iPhone 6s concerns the cameras, with the main, rear-facing shooter receiving a

boost from 8 to 12 megapixels, and the front camera rising from a pitiful 1.2 to a more respectable 5 megapixels. Note that, just as with the iPhone 6, the iPhone 6s still lacks optical image stabilisation; that feature is enjoyed only by the larger iPhone 6s Plus model, making them slightly more accomplished in low light.

The new front-facing camera captures much more detailed shots, and has one ingenious feature that will help you capture better selfies, in low light: turn on the flash capability and the iPhone 6s will employ its screen as a makeshift flash.

Apple being Apple, though, it hasn't stopped there. Its screen-based flash is a two-stage affair, flickering on once in bright white to provide full illumination, then again in a lower intensity yellowish colour in an attempt to balance the skin tones, a bit like the dual-tone LED flash on the rear. It works, too: although low-light selfies do still look pretty noisy, there's a reasonable amount of detail and skin tones look realistic.

A rise in the number of pixels is often accompanied by increased noise and, thus, lower quality. I've seen no evidence of that in the photographs I've captured so far. In low light and daylight, every snap has been well balanced in exposure, with perfect white balance and they've been bursting with detail.

Then there's the new Live Photos feature. Essentially, they're like always-on Vines built into the camera app, capturing 1.5 seconds of motion footage before and after you touch the shutter button. It's switched on by default, indicated by a small circular icon on the screen and a yellow LIVE indicator to show that video is being captured.

Most of the Live photos I captured when I first started using the phone ended with footage of the pavement, or my feet. For the best results, I slowly realised I needed to tweak my behaviour, and keep the camera pointed at its subject until the yellow indicator disappeared.

It's a fun feature, but will it become part of the fabric of social media, or subside into obscurity over time? I suspect the former, but it will take time for the big social websites to build in support. Currently, only



**ABOVE** The rear-facing cameras have been upgraded to 12 megapixels

other Apple device owners are able to view Live Photos.

## ■ Video capture

The other big camera news is that it can finally capture 4K video. The number of people who own devices capable of displaying such detail-packed footage is still small, but there's no denying that the video the iPhone 6s produces is much sharper than the 1080p footage captured by the iPhone 6. Still, what's likely to be more

useful to more people is

the iPhone 6s' ability to retain detail under zoom. Load the video into the preloaded iMovie video-editing app, which can now both process and export 4K footage, and you'll find you can crop heavily into your 4K footage without reducing image quality much.

4K is turned off by default. Clearly Apple is worried about customers with 16GB iPhones saturating their storage space, and for good reason: 4K footage chomps its way through around 380MB per minute.

## ■ Design

The iPhone 6s isn't entirely identical to its predecessor. If you're used to

handling an iPhone 6, you'll notice the first time you pick up a 6s that it's a touch heavier, primarily due to the extra electronics required to make 3D Touch work. It's also thicker, but it has expanded by such a small

amount that I struggled to tell the difference, even with the two phones side by side on my desk.

Apple has made improvements to the materials employed in the iPhone 6s' design. The aluminium frame is built from a stronger alloy now – 7000 series aluminium to be precise – which happens to be among the strongest forms of aluminium available. The screen glass has been strengthened, too, although that's impossible to verify without trashing a handful of rather expensive iPhones.

The final design change is the addition of a fourth colour option – “Rose Gold” – to supplement the existing Gold, Space Grey and Silver models. In this humble reviewer's opinion, the new colour is execrable, but everyone's taste is different. You may well find you like it if you take

**“It's the sort of leap forward that may well transform the way we all use our phones in the future”**

**+** 3D Touch is a brilliant advance while the new cameras provide superb results  
**—** You pay for the privilege



the time to saunter down to your nearest Apple Store.

## ■ Performance

And yes, the iPhone 6s is faster than it was last year. The new A9 processor, Apple would have us believe, is up to twice as fast as the A8 in the iPhone 6, while graphics performance is claimed to be faster still. I've run the phone through a few benchmarks, and it's certainly much quicker.

The GFXBench gaming test results are particularly illuminating: the iPhone 6s is so fast in the onscreen tests that its frame rate is capped by the display's refresh rate, so results hover around 60fps.

It's only when you run the off-screen tests that you see how powerful the new A9's GPU has become, with the T-Rex HD test being dispatched with careless ease. No other phone I've tested has got anywhere near the iPhone 6s' 80fps result, and unlike some of the more powerful chips powering Android phones, Apple's flagship doesn't get uncomfortably hot to hold while achieving such heights.

What this means in the real world is less clear. To all intents and purposes, this is a phone that no modern app or game will stress, and in daily use you'll hardly notice the difference. Apps do launch a fraction of a second quicker. Transitions around the OS – from homescreen to the search screen and the new Siri Suggestions screen – feel ever-so-slightly speedier, too. The only aspect of real-world performance significantly quicker is the Touch ID sensor, which now offers almost instantaneous unlocking.

## ■ Battery life

I was concerned to discover that Apple had, instead of increasing battery capacity to match the more powerful processor, reduced it. I'm pleased to report, though, no significant difference between the two phones in real-world use.

After a 5.30am start, and continuous testing, capturing lots of live photos and 4K video, installing apps, and listening to two hours of streaming audio over 4G, the iPhone 6s sat on 50% ten hours later. My full tests backed this up; for example, playing a 720p video in flight mode with the screen set to 120cd/m<sup>2</sup> brightness saw a drop of 7.2% per

**ABOVE** The frame is now built from stronger 7000 series aluminium

hour. In short, this is a phone that offers solid, day-long stamina.

## ■ Screen quality

On the surface, little has changed when it comes to the display. It's as bright as ever, with well-balanced colours across the board, and dim the backlight and there's a suggestion of greyness around the edges and corners. Still, given how much work Apple has done in squeezing the 3D Touch system in and the Taptic Engine, I'm willing to forgive it this small indiscretion. And, in fact, when I measured with our X-rite i1Display Pro colorimeter, it's clear this is still one of the best screens around.

It reaches a maximum brightness of 572cd/m<sup>2</sup> and delivers an eye-popping contrast ratio of 1,599:2. Colour accuracy is exemplary, too, with the screen covering 95% of the sRGB colour space and its average Delta E (a measure of difference between the colours on screen and what they're supposed to look like) hits a superb 1.02.

It's a match for the Samsung Galaxy S6 Edge's

## iPhone 6s vs 6s Plus

The 6s Plus doesn't only give you a bigger screen to play with, it gives you a nominally sharper display, too. The 4.7in 1,334 x 750 screen on the iPhone 6s has 326 pixels per inch (ppi), while the Full HD panel on the 6s Plus delivers 401ppi. To the naked eye, however, the difference isn't perceptible. We've reached a point where extra pixels are doing little more than draining the battery.

Otherwise, there's very little difference between Apple's two new handsets. Both have the same processor, camera and wireless chips. The 6s Plus has a bigger battery, and if Apple's own figures can be trusted, it seems the benefits aren't entirely cancelled out by the larger screen. Apple claims the 6s Plus will deliver 14 hours of HD video playback, compared to only 11 on the 6s; 4G internet usage is pegged at 12 hours on the 6s Plus, compared to 11 hours on its smaller sibling. In practice, however, they're both going to go on charge every night.

So what about the key differentiator: the price? We think 16GB is insufficient for a modern smartphone, so moving up to the 64GB storage bracket sees the iPhone 6s come in at £619 SIM-free and the 6s Plus at £699. The 128GB model adds another £80 to the bill for both models. That's an extraordinary amount of money for a phone, but then these are extraordinary handsets.

display, but without the intensely saturated colours.

## ■ Verdict

Year after year, Apple has churned out new iPhones with great success, alternatively boosting power and camera resolution, then refining the design to the point at which it was tough to see where it could go next.

With 3D Touch, however, Apple has delivered the next step in the evolution of the smartphone – soon everyone will be copying it. It's done so without compromising screen quality or battery life, and has even found the time to improve the phone's cameras, its all-round resilience and the performance and internals.

The biggest disappointment is that there's still a 16GB model. That means the entry model for most people is the 64GB iPhone 6s, which is a significant investment. It's £619 inc VAT SIM-free, and starts at around £40 per month with an upfront fee of £125 on a two-year contract. That's almost as expensive as the 5.7in, 64GB Samsung Galaxy S6 Edge+, and a good deal more than the 64GB Samsung Galaxy S6.

However, if you want to be at the forefront of smartphone technology then there's nothing else to do but buy an Apple iPhone 6s. As luck would have it, it also happens to be a mighty fine smartphone. **JONATHAN BRAY**

**BELOW** The display is a match for the Samsung Galaxy S6 Edge's



## SPECIFICATIONS

Dual-core Apple A9 SoC with integrated M9 coprocessor • 2GB RAM • 16GB/64GB/128GB storage • 4.7in, 750 x 1,334 IPS display • 12MP/5MP rear/front cameras • dual-band 802.11ac Wi-Fi • 4G • fingerprint reader • NFC (for Apple Pay only) • 1,715mAh Li-ion battery • iOS 9 • 1yr RTB warranty • 67 x 7.1 x 138mm (WDH) • 143g



PREVIEW

# Apple iPad Pro

The 12.9in iPad is powerful and expensive, but turns Apple's tablet into a truly professional tool

While overshadowed by the iPhone 6s, the really big news from Apple this month is the 12.9in iPad Pro. I was fortunate enough to spend some time with the device – and it's a colossal new product from Apple.

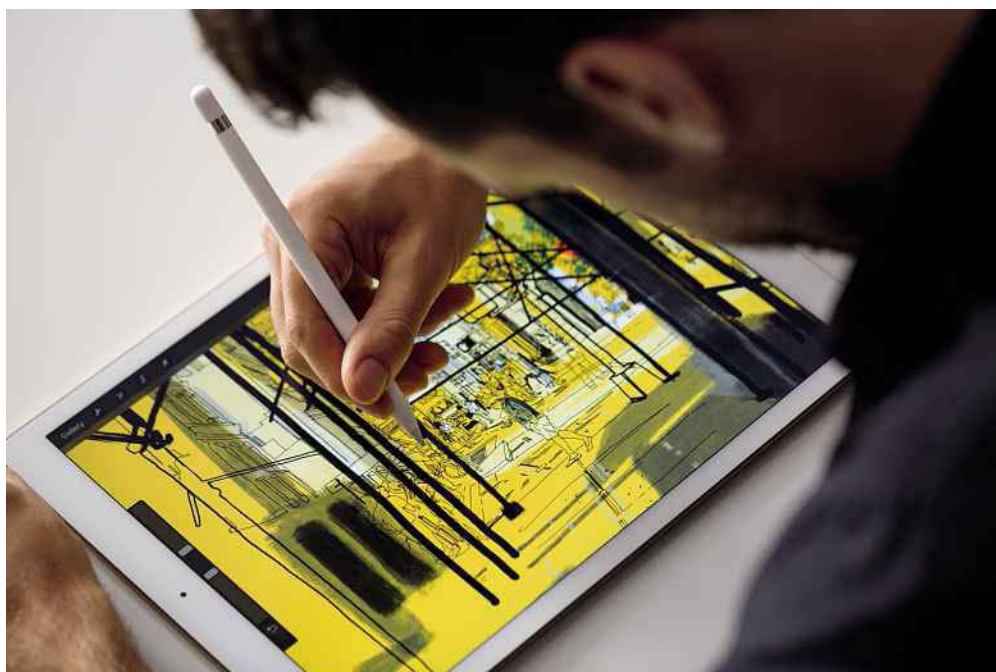
To think of the iPad Pro as simply another iPad doesn't do it justice. It has more in common with Microsoft's Surface and represents a major step into the business market for Apple.

Before I got my hands on the Pro, I was struggling with the question: "What can the Pro do that the iPad Air can't?" However, after spending a brief period of time with the device, its forte became clear: multitasking.

The iPhone 6s' 3D Touch allows users to get a snippet of information without having to leave an app, and the iPad Pro's increased screen size and beefed-up processing power achieve effectively the same thing. How? The iPad Pro uses its big screen to either display two apps side by side, or float one app on top of another.

The display itself is incredible. It's big, bright and packs 5.6 million pixels into its 12.9in, 2,372 x 2,048 (264ppi) Retina display. Apple still claims a ten-hour battery life, thanks in part to new techniques, such as the ability to dynamically slow down the refresh rate of the screen in order to preserve power. It also helps that there's more room for the battery to stretch out inside.

That's due to the iPad Pro being much bigger than you think. Using it is similar to how a ten-year-old must feel when he gets his hands on a regular iPad. I found that holding the device between the corner of my elbow and hand enabled me to operate the Pro with ease and comfort, but this is a device that's



clearly been designed for use on a table or another flat surface. Hence the \$169 Smart Keyboard.

This is where the iPad Pro is most like the Surface Pro, but it loses points for not having a touchpad option – something I instinctively hunt for when using any laptop-type keyboard. As with the Surface Pro's Type Cover, Apple's variant doubles up as a screen protector, stand and cover – it even magnetically snaps into place in a similar way. It's expensive, but typing on it is a joy, with each keystroke rewarded with a satisfying thud.

The other main accessory is the Apple Pencil, which I instantly fell in love with. It won me over when the Apple representative was sketching something. He suddenly stopped using the nib of the pen, tilted the Pencil 45 degrees and began shading the picture,

to which the Pro responded with a lifelike pencil-shade effect.

The very slender Pencil is attractive in its own right, but it's also functional, with its battery lasting three months at a time. When you eventually run out of power, the lid can be removed to reveal a Lightning connector, which enables you to charge it

**ABOVE** To get the most out of the iPad Pro, you'll need to invest in extras such as the amazing Pencil

via the iPad Pro's Lightning port. Very neat.

Inside the iPad Pro is the new A9X SoC (system on a chip), which Apple claims delivers increased power over the A8X chip in the iPad Air 2, including twice the memory bandwidth and superior graphics performance. The impact I witnessed this having on the iPad Pro wasn't as impressive as I'd expected. I noticed a small amount of lag when I began to float a video over the Pro's Safari browser. While barely noticeable, it could be a sign of how much strain the iPad Pro's internals will be put under when multitasking on such a

big screen. It's something you can expect us to test closely when we get the device into our labs.

There are no official UK prices as of yet, but the 32GB iPad Pro will cost \$799 (Wi-Fi only),

the 128GB is \$949 and the 4G 128GB is \$1,079. Add the Smart Keyboard and Pencil and you're looking at a minimum of \$1,067 for the full package, which means it's certainly no impulse buy, even with a generous dollar-to-pound conversion rate.

Tim Cook was right when he stood on stage at San Francisco's Bill Graham Civic Auditorium and said: "Today we have the biggest news in iPad since the iPad." It's a new beast.

There's so much to like about the new iPad Pro: the size and power, as well as the Smart Keyboard and Apple Pencil. However, will it be enough to reignite the supposedly waning enthusiasm for iPads? Very possibly. Look out for our full review when we get our hands on the final version. **DAVID COURT**

**"The iPad Pro has more in common with Microsoft's Surface and represents a major step into the business market for Apple"**

**LEFT** The 12.9in screen brings a new dimension to Apple's iPad range

**+** A beautiful screen matched by bags of power, while the Pencil is a thing of joy  
**—** The price, especially when it doesn't include the keyboard







# Microsoft Office 2016 for Windows

Office remains the strongest professional office suite around,  
but should you upgrade? That's a different question

Contributors: Tim Anderson, Jonathan Bray

SCORE ★★★★★

**PRICE £100 (£120 inc VAT); Home and Student standalone; from £6/mth as part of Office 365**

Some of my earliest memories of using a proper computer involve Microsoft Office. Since those heady days in the early 1990s, I've spent probably more time using Office apps than I have anything else.

I'm not the only one who has spent more time than is healthy using Microsoft Office, though – it has been used by businesses across the world as the primary tool for productivity for nigh-on 20 years. That's why, with the launch of Office 2016, the news that not an awful lot has changed shouldn't come as a huge surprise.

The biggest change you'll see in Office 2016 is a fresh lick of paint, with all the various apps gaining toolbars coloured in their signature livery. Most of the apps have been made more searchable via the new "Tell Me" feature, but apart from a few small additions, that's it. There has been no dramatic Windows 10-style overhaul, not even any eye-catching Cortana integration.

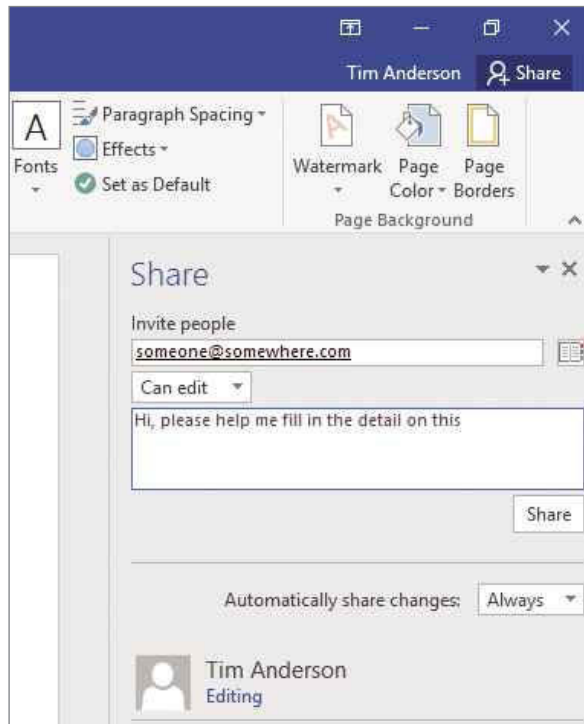
## ■ The future

This is because Office doesn't need an awful lot of work. Aside from Outlook, all the apps deliver more features than most users know what to do with, and they do their job well. Many workers rely on specific features of Word, Excel and PowerPoint to carry out their jobs, and there's nothing else on the market that can rival its apps for power and breadth of features.

Another reason is that the device landscape is shifting dramatically, and Microsoft is rightly focussing more of its attention on getting its mobile apps working well on tablets and other mobile platforms. The advent of the Apple iPad Pro is a signal that Microsoft can't rely on the traditional PC platform to deliver a steady stream of users forever.

Perhaps the biggest change, however, is the shift away from one-off perpetual licences for major, business-critical software like Office to subscription-based solutions. With Microsoft now firmly focussed on its Office 365 subscribers, who receive the Office 2016 update for "free" (along with all other future updates), it's perhaps understandable that the firm is less interested in delivering a big splash of features every three years or so, and more in delivering further improvements.

That's fine for those who have already bought into the Office 365



way, and there are plenty of reasons for taking on a subscription, not least the ability to install Office on multiple machines for £8 per month.

However, for anyone who doesn't need that, this brave new world isn't good news. There's no getting away from the fact that Microsoft Office 2016 for Windows is a damp squib from a new features point of view, and I wouldn't recommend you upgrade to Office 2016 as a standalone product from Office 2013.

There simply isn't enough new here to justify a spend of £120 (for the Home and Student edition). You're better off waiting for the next release or biting the bullet and jumping on the subscription bandwagon.

## ■ Word 2016

Word is one of the applications to get the all-new "Tell Me" lightbulb above the ribbon, and it works well as a quick way of finding features without having to hunt through the various ribbon tabs. You can do a word count, for example, by typing Alt+Q to focus on Tell Me, then typing "word count" and pressing Enter. Even better, next time you type Alt+Q, your previous selection pops up by default, further speeding up your work.

The big new feature is real-time co-authoring, which works in

**ABOVE** Changes show up for all authors in the impressive new co-authoring feature

**ABOVE RIGHT** Smart Lookup opens an Insights panel with the search results

**"There's no getting away from the fact that Microsoft Office 2016 is a damp squib from a new features point of view"**

**BELOW** The Tell Me lightbulb found above the ribbon is an easy alternative to hunting through tabs



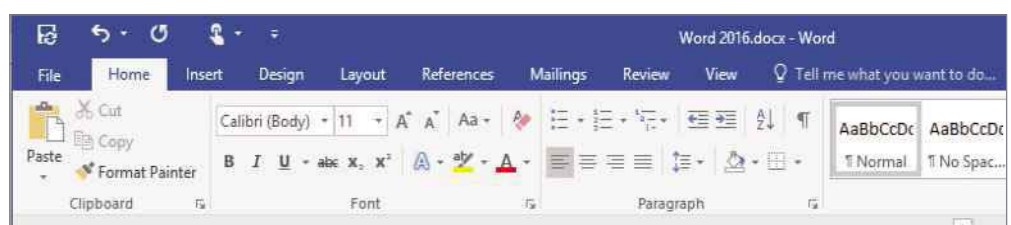
conjunction with Office 365 or OneDrive. Once you have saved a document to one of these locations, you can click the Share button at the top right and select or type an email address. The recipient gets a link to the document, and, provided they use either Word 2016 or Office Web Apps, they can edit the document, with changes showing up for all co-authors as they type. In practice, there is a short delay, but this feature is technically impressive.

Word has had collaboration built in before, but this version is more dynamic, with changes appearing as they're typed rather than when they're saved. The one catch is that you have to use Microsoft's cloud – an on-premises SharePoint server is not enough, and it isn't bug-free. I saw glitches appear as I was testing the software, such as a document that should have been shareable raising the mysterious error: "Sorry, something is preventing us from sharing this."

Another Word enhancement is called Smart Lookup. This is a right-click option for highlighted text, and replaces "Search with Bing" in Word 2013. Type "Ada Lovelace", for example, perform a Smart Lookup, and an Insights panel will open with a picture and biographical information. In the end it's just a web search, and searching in a web browser gives richer

results, but having information in a panel within Word makes it easier to use the information while you type.

Equation editors can be fiddly to use, so mathematical tablet users may like the new "Ink to Math" converter, which opens an input panel where you can handwrite an equation. This attempts to read your writing, and then inserts it into your document. I had some difficulty getting the editor





to recognise my sigmas and round brackets, but it recognised most of my other symbols without a problem.

You may correctly conclude that Word 2016 lacks new features, particularly if real-time co-authoring isn't something you need. In reality, the upgrade is a hard sell to customers with existing perpetual licences.

## Excel 2016

Microsoft's spreadsheet and data-analysis tool is the jewel in its Office crown. It's a behemoth, an app so widely used, and so far in front of its competition, that it doesn't need a big boost to its capabilities – fine-tuning is all that's really required.

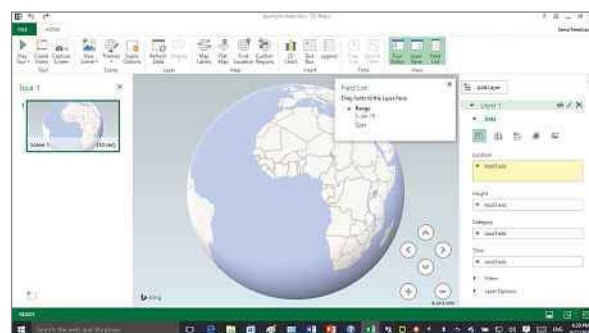
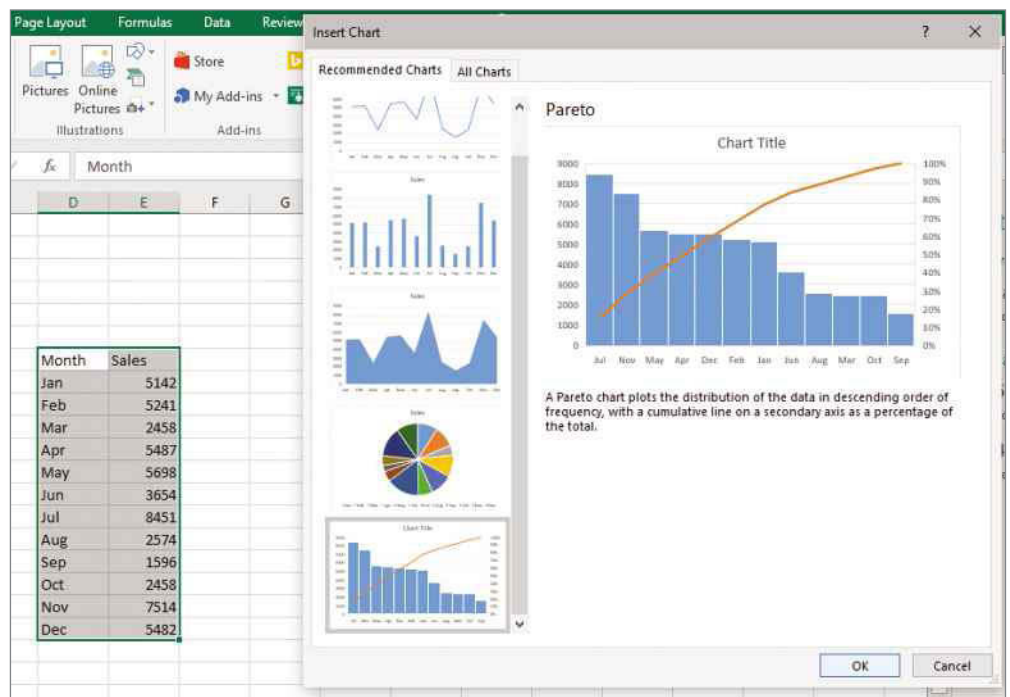
And that's what it gets in the 2016 release. It misses out on the real-time collaboration features found in Word, PowerPoint and OneNote, but gains a new appearance, which is nice but not necessary, plus a scattering of welcome enhancements.

The new features start with six new chart types:

- **Treemap**, showing hierarchical data as nested rectangles
- **Sunburst**, showing hierarchical data as concentric rings
- **Waterfall**, using floating columns to show changes between full columns
- **Histogram**, a statistical chart showing data distribution
- **Pareto**, combining columns with lines to show both individual and cumulative values
- **Box and Whisker**, showing a range of values with the average values in a box, while lines are drawn at either end to show maximum and minimum values.

The beauty of Excel's charts is the ease with which they can be created and modified, and the new charts are very welcome. There's a new Forecast Sheet wizard that automates building a sheet that forecasts data based on an existing series. It's supported by an enhanced Forecast function.

Excel's powerful PivotTables tool is also improved in this release. A



pivot table lets you analyse data by having Excel perform sums, counts and averages according to the columns you select, and cross-tabulate one set of data with another. Excel 2016 adds features including automatic relationship detection and time grouping, drill-down buttons that let you zoom in and out of data, and delayed updating so you can make several changes before Excel calculates the results.

The Power Query add-in, used for connecting to data from a variety of sources, is now built into Excel, integrated into the Data ribbon. And

**TOP** The new Pareto chart type combines columns with lines to show different values

**ABOVE** The 3D maps, once known as Power Maps, is now part of the main product

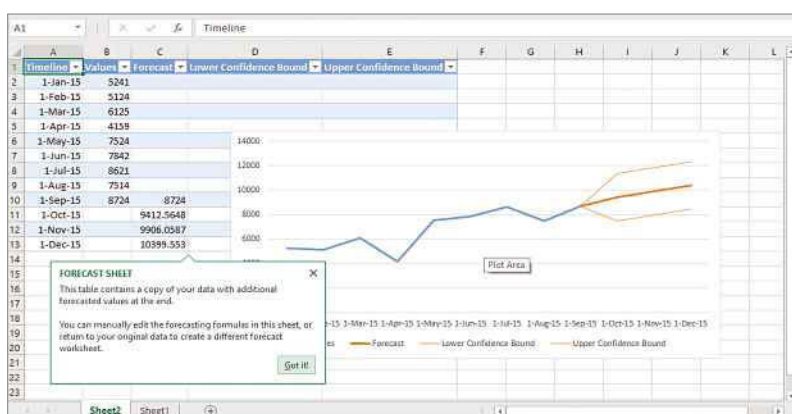
3D maps, an add-in previously known as Power Maps, is also now part of the main product, provided you activate the Data Analysis add-in.

There are smaller improvements, too. When you insert a photo into Excel it picks up on the orientation information held in the EXIF data – and rotates the photo accordingly. You also get the Tell Me feature, as found in Word, Outlook and PowerPoint. Hit Alt+Q (the quickest way to access the feature) and you can search for tools and functions by keyword.

This doesn't work quite as well as you might expect it to. For example, typing "set a heading row" into the new wizard yields nothing helpful, but typing "freeze panes" brings up the option to freeze the top row. Furthermore, it only searches the menu and ribbon bar tools, not Excel's functions.

If you use Office 365 or SharePoint, you can now access document history from within Excel. The File History panel shows previous versions, and by selecting a version you can preview and restore it. Excel also benefits from the Ink to Math equation editor, as found in Word.

Just as with Word, there's nothing significant about the upgrades to Excel in this release, but most of them are usable whether you buy a perpetual licence or plump for Office 365, and everything is nicely implemented. Excel is the Office application that its competitors find hardest to match. It combines deep features with usability and a clean user interface more successfully than the other Office applications, provides businesses with tools that have



**LEFT** The Forecast Sheet wizard creates a new sheet that forecasts data based on a series



become indispensable for many, and it remains the spreadsheet application to beat.

## ■ Outlook 2016

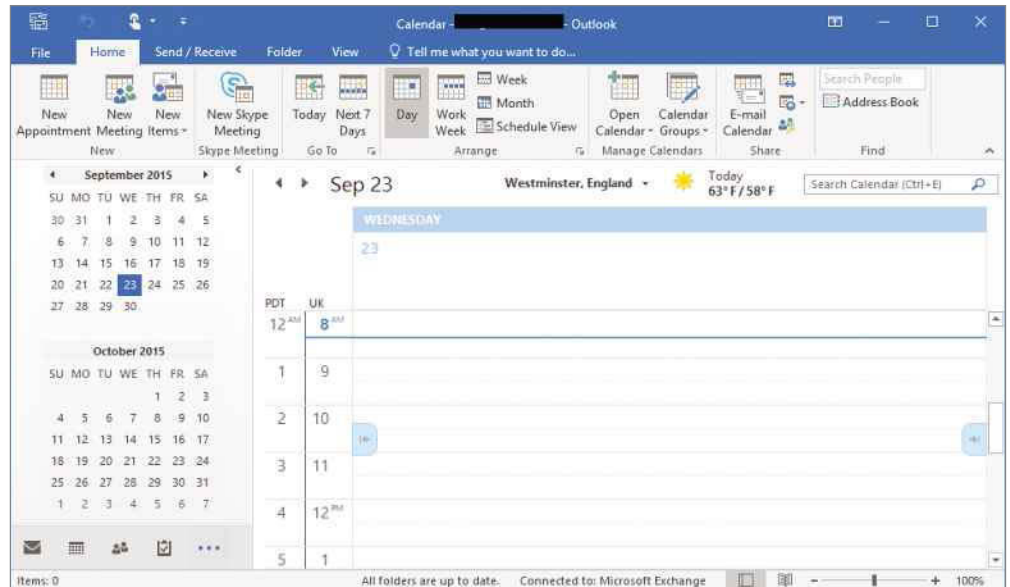
Outlook does a great job of integrating email, contacts, calendar and tasks, but has long suffered from an overly complex user interface and has plenty of long-standing annoyances. It uses embedded Word as the email editor, for example, and a side-effect is the poor rendering of HTML emails and difficult formatting if you want to intersperse your reply with quotes from the message you've received.

Little has changed in the Office 2016 release, but there are a few new features. The most interesting concerns the sending and sharing of attachments. When you attach a document stored in OneDrive to an email, for instance, Outlook sends a link to that document by default, rather than attaching the file. Unless you adjust the permissions, documents sent in this way also give editing permissions to the recipient. This is great for collaboration, but only provided users understand what is happening. However, if you don't want to do it the new way, you can send cloud documents with view-only links, or as traditional attachments – and if you select a document stored on your PC, it's attached in the normal way.

There are also a couple of new features that are really part of Office 365, but which are now also in Outlook. One is the Clutter folder, intended for messages that are low priority, as distinct from junk mail. Clutter depends on learning algorithms implemented in Office 365, but it also shows up in Outlook now; this means, if you come across a message you think the algorithm has missed, you can choose "Move to Clutter" from a right-click message menu. This not only moves the message across to the Clutter bucket, but also helps to improve the accuracy of the service. You still need to visit the Office 365 site to turn Clutter on or off, however.

The other new Office 365 feature is Groups, for which you need an Enterprise subscription. A Group is effectively an enhanced mailing list, and one restricted to members of your organisation. You can send emails to the group, but you also get a shared calendar and a document storage area for basic collaboration. Old-style contact groups are still available too.

If you don't use Office 365, there isn't much new other than the fresh look, which applies throughout the suite, and the Tell Me feature for searching for commands or help. Since Outlook has many buried



**ABOVE** The new Groups feature includes a shared calendar

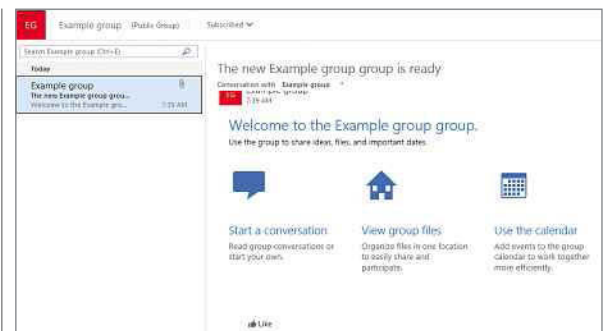
options, Tell Me has potential. One example is if you're writing an email and want to add someone to the bcc (blind copy) list, or change the From address. Outlook hides these options by default, and you need to click the Options tab and show the fields before you can use them. Now, you can click Tell Me, type "bcc", hit Enter, and the option appears.

It's disappointing that so little has been done to improve a core part of Office 2016. With former Acompli CEO Javier Soltero having taken over as corporate VP for Outlook – Acompli being responsible for the mobile versions of Outlook – I hope he can bring usability improvements to the desktop product over time.

## ■ OneNote 2016

The Office 2016 version of OneNote is essentially the same as OneNote 2013, although with the more colourful look and feel as in the rest of the suite. Bizarrely, however, it doesn't include the Tell Me feature prevalent across the rest of the applications.

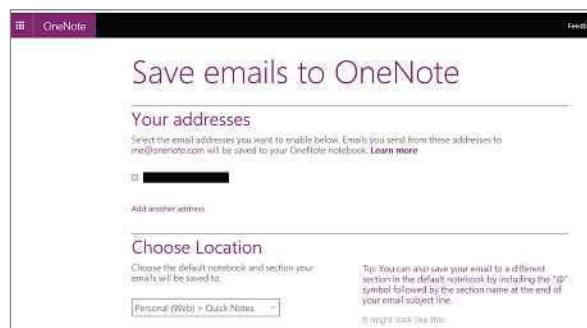
Despite the lack of new features in this particular release, there are plenty of things that have happened to OneNote since Office 2013. One handy feature is the ability to send



**ABOVE** A Group is effectively an enhanced mailing list for your colleagues

**"OneNote remains Office 2016's unsung hero, and changes introduced over the years add up to a decent note-taking system"**

**BELOW** Content can be sent from OneNote to a notebook page on OneDrive



notes by email. The idea here is that you may find something you want to capture in OneNote when the application itself isn't to hand. If you send an email to [yourname]@onenote.com, the content is sent to a new page in a OneNote notebook stored on OneDrive. You need to set

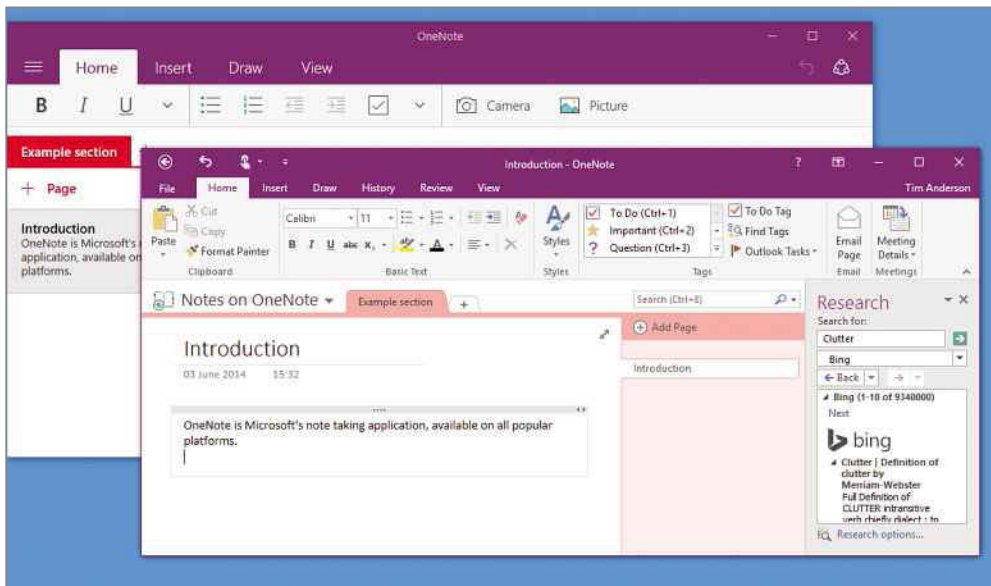
this up by registering the email address on **onenote.com**, where you can also specify the recipient notebook.

Other ways to send content to OneNote include Clipper, a browser

link that can capture web pages, and Office Lens, which is a mobile scanning app for iOS, Android and Windows Phone that can send images taken by your phone's camera.

Still, OneNote remains Office 2016's unsung hero, and changes introduced over the years add up to a decent note-taking system.

One of my favourite features is the audio-recording system, which remains in place here. Start taking notes, hit the record button and the two are cleverly linked together as you type. This means you can select a written note and play the recording, or play the recording and see the related written notes highlighted during playback. Irritatingly, its one fault – terribly low recording quality



default settings, which in a new install of OneNote 2016 are 12Kbits/sec, 16kHz mono – hasn't been rectified in OneNote 2016.

And Collaboration in OneNote is crying out for the kind of real-time co-authoring enjoyed by Word and PowerPoint in this release (and by users of Google Drive the world over). You can still work on shared notes, but other users' changes won't appear as they type them, meaning you have to wait until they sync, which can take some time.

However, despite the lack of new features, OneNote remains a powerful and flexible note-taking system, and is now well supported across all popular platforms, including the web. The next job, and perhaps one Microsoft ought to have undertaken in Office 2016, is to push users into using it more often than Word, and making more use of its undoubtedly useful toolkit.

## PowerPoint 2016

Microsoft's ubiquitous presentation graphics application gets the full Office 2016 treatment in this release, including Tell Me command search and help, a more colourful appearance by default, Smart Lookup for Bing search results in a panel, and simultaneous co-authoring.

Note, though, the latter only works if you've saved a presentation to OneDrive or Office 365. As long as that's been done, you can click the Share button in the top right of the application window and send an invitation to others to edit the document.

However, the process is far from seamless. Once your contact gets the link to the document, the document is opened in Office Web Apps, and if you want to edit the presentation in the desktop app, you have to click yet

another option to finally open it in PowerPoint. This isn't the end of the irritations, either, with security warnings first from the browser, and then from PowerPoint, stating "be careful – files from the Internet can contain viruses", getting in the way.

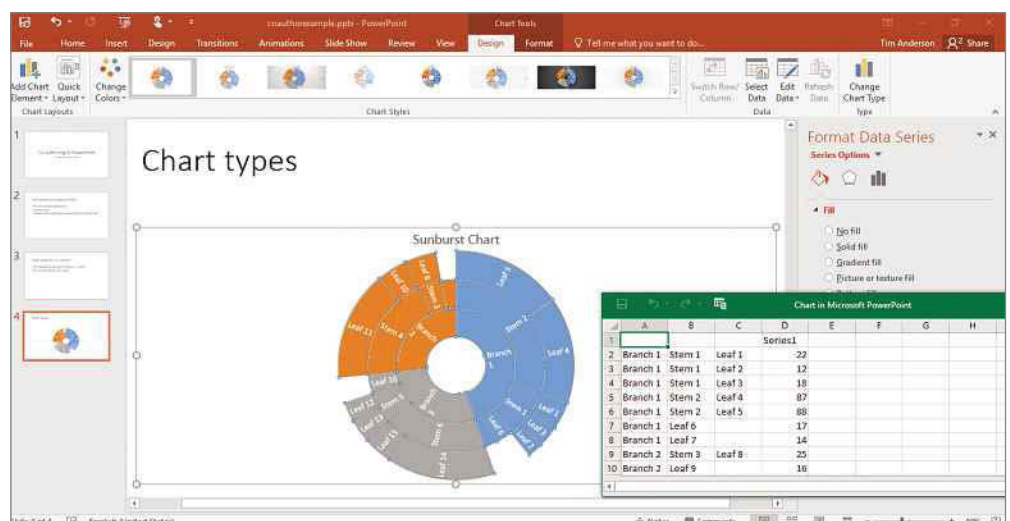
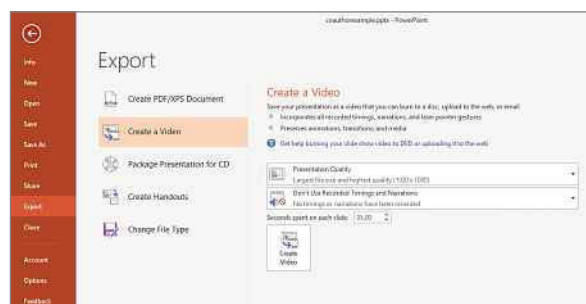
At this point, all contributors can work simultaneously. It still isn't perfect since you don't see changes until the document is saved.

Although the process worked when multiple contributors were working on separate slides, it slipped up when we tried amending a bullet point simultaneously. PowerPoint messed up the merge, silently moving

**ABOVE** Despite the lack of new features, OneNote remains a powerful tool

**BELOW** You can export a presentation as a video and then upload it to YouTube

**BOTTOM** PowerPoint 2016 also benefits from the new charts introduced in Excel



some text from one bullet to the next. Users will need to check for issues such as this.

One useful addition is that PowerPoint 2016 benefits from the new chart types introduced with Excel, namely Treemap, Sunburst, Histogram, Box and Whisker and Waterfall. When you edit chart data, an embedded Excel sheet appears – a good example of Office 2016's components working together as they should. Tablet and stylus users can use the Ink to Math equation editor, as found in Word and other Office 2016 applications.

That's it for new features, though, making this yet another application that has received only light changes in Office 2016.

No doubt the PowerPoint team has been distracted by the work carried out on the companion applications in Office Mobile, and in the Mac edition, which was released earlier this year with many improvements.

That said, it's worth noting that, since PowerPoint 2013 was introduced, the Office development team hasn't been idle. Other features, such as screen recording, which lets you make a video by capturing all or part of the screen together with an audio commentary, have been added in recent updates.

On the subject of videos, it's worth noting that you can export a PowerPoint presentation as a video, recording your narration and even inking and screen pointing, which can then be uploaded to Office 365 or YouTube. This makes PowerPoint, together with a microphone, a handy all-in-one tool for creating and publishing lectures and tutorials.

PowerPoint has always been a flexible tool for presenters and educators alike. That hasn't changed in this release, despite the relative paucity of new features, meaning PowerPoint remains a capable and mature product. ●

## Samsung Galaxy Tab S2 8in

Fast, slim and equipped with a wonderful display, the Tab S2 is as good as compact tablets get

SCORE ★★★★★

PRICE 32GB, £250 (£300 inc VAT)  
from handtec.co.uk

Harder, better, faster, stronger. It's almost as if Daft Punk had travelled into the future and written a song about Samsung's new Android tablet. The 8in Galaxy Tab S2 is designed to fill the premium Android hole in your life, and give Apple's iPad mini a run for its money.

Emerging from its packaging in a flurry of crinkly plastic and sparkly cardboard, the Tab S2 is the very definition of compact beauty, all slender metal shaped to perfection. Measuring 5.6mm from the glass at the front to its flat aluminium rear, it's as barely-there as tablets come.

In fact, it's so thin that the (surprisingly decent) 8-megapixel camera at the rear juts out by a couple of millimetres, a tiny metal ring serving to protect the slightly inset f/1.9 lens so you don't end up scratching it every time you plonk it on a table. Thankfully, the pared-down design doesn't mean Samsung has struggled to accommodate all the usual premium Android tablet features: you get nippy 802.11ac Wi-Fi (or 4G for around £60 more), Bluetooth 4.1, a front-facing 2.1-megapixel camera and a microSD slot to expand the 32GB of storage.

All told, this looks and feels exactly like a high-end Android tablet should. Despite weighing a feathery 265g – 66g lighter than the Apple iPad mini 3 – the metal shell is taut and flex-free. Everything about the Galaxy Tab S2 feels suitably expensive.



Which brings me neatly onto the Tab S2's Super AMOLED display, which is absolutely delicious. The 4:3 aspect ratio screen feels more spacious than the 16:10 displays on the previous Tab S tablets, but it's the image quality that truly impresses. At least, once you switch off the excessive, oversaturated colours of its Adaptive Display mode. Switching to the boring-sounding Basic mode, on the other hand, provides some of the most well-balanced images we've seen on a tablet.

And the quality is truly superb. Our X-Rite i1Display Pro colorimeter reported a maximum brightness of 334cd/m<sup>2</sup> (contrast is effectively infinite due to the AMOLED technology), while the Basic mode successfully reproduced almost 99% of the sRGB colour space.

The 3GB of RAM and octa-core Exynos 75433 processor combine to create a superbly slick tablet: it darts back and forth eagerly between menus and applications, and scrolls smoothly through the most complex web pages. Its results of 1,256 and 4,276 in the single- and multi-core

elements of the Geekbench 3 benchmark outpace every other compact tablet on the market.

It isn't an across-the-board victory, however,

**LEFT** The S2 doesn't just look like a premium tablet – it feels like one too

**ABOVE** The Tab S2's display is simply brilliant, with the most natural colours we've seen



**"The Samsung Galaxy Tab S2 is the very definition of compact beauty, all slender metal shaped to perfection"**

**+** The best screen you'll see anywhere on a tablet

**-** It's undeniably expensive, and gaming performance isn't the best

as gaming performance still isn't up with the best. An average frame rate of 20fps in the GFXBench 3.1 T-Rex HD onscreen test isn't bad, but the Intel Atom hardware in the Asus ZenPad S 8.0 manages 26fps. In fairness, there's more than enough power here to take on any of the latest Android games.

As ever, Samsung hasn't been able to resist tinkering with stock Android. It's also a slight disappointment that the Tab S2 ships with Android 5.0.2 beavering away under the TouchWiz skin rather than the very latest build, but Samsung has promised that an upgrade will surface soon.

Thankfully, TouchWiz UI doesn't clutter up the tablet too much. There's both a clock and weather widget centre-stage on the homescreen; a few apps scattered around such as Samsung's S Planner calendar app, its own app store and the Microsoft Office apps; and also the Briefing newsfeed screen, which pops up when you swipe right on the homescreen. If the Samsung apps really get your goat, then you may find it annoying that you can't uninstall many of them, but they never bothered me.

There's one glaring problem with the fad for ever-slimmer tablets – it leaves precious little room for things such as the battery. And as the Tab S2 now relies on a relatively small 4,000mAh unit, which is 18% smaller than its predecessor, you'd expect stamina to take a hit. The move from a 28nm processor to a slightly more efficient 20nm CPU seems to have done the trick, though. With the

screen calibrated to our usual 120cd/m<sup>2</sup>, and Wi-Fi switched off, the Samsung kept going for a creditable 14hrs 54mins.

So, what's the catch? Only that you'll now need to find £300.

That's a lot of money for an 8in tablet, especially when the 32GB iPad mini 2 costs £259. The most important aspect of any tablet is the screen, though, and here the Galaxy Tab S2 just knocks it clean out of the park. Yes, it's expensive, but it's also refined, dainty and runs Android. If that's just what you've been looking for, you should probably hang the expense. **SASHA MULLER**

### SPECIFICATIONS

Octa-core Exynos 75433 • ARM Mali-T760 • 3GB RAM • 32GB storage • 8in 1,536 x 2,048 Super AMOLED display • 802.11ac Wi-Fi • Bluetooth 4.1 • 4,000mAh battery • microSD • Android 5.0.2 • 8MP rear/2.1MP front cameras • 2yr RTB warranty • 134.8 x 5.6 x 198.6mm (WDH) • 265g





## OnePlus 2

The second generation of OnePlus' affordable flagship handset is here, and it's a very good phone indeed

**SCORE** ★★★★★

**PRICE** Invite only: **16GB, £199 (£239 inc VAT); 64GB, £241 (£289 inc VAT)** from [oneplus.net/uk](http://oneplus.net/uk)

The original OnePlus One was an incredible bargain – a smartphone costing less than £200, yet capable of standing up to flagship phones from Samsung and Apple. The OnePlus 2 refines the formula, squeezing premium hardware into a phone that starts at a reasonable £239 inc VAT.

In the hand, the OnePlus 2 feels weighty and expensive. The buttons have a solid click to them; the magnesium-alloy frame doesn't bend when you twist it; and the finish feels impressively luxurious. I tried the Sandstone Black version, which has a rough texture that I really like; there's also a Kevlar option, plus wooden finishes in Bamboo, Rosewood and Black Apricot.

Wake it up and the 5.5in touchscreen looks bright and even, thanks to an IPS panel, although colours can appear a touch pale. In tests, it reached a maximum brightness of 415cd/m<sup>2</sup> and covered only 88% of the sRGB colour space. Don't get hung up on the resolution, though. Many recent flagships have featured Quad HD displays, but the OnePlus 2's 1080p resolution is perfectly sharp enough unless you want to look at it under a magnifying glass – or use it as a screen in a VR headset.

Below the screen sits a capacitive home button and shortcut keys. A fingerprint reader built into the home button works remarkably well; there's also a three-way toggle switch on the phone's left-hand edge, which lets you switch quickly into Android's mute or Priority Interruptions modes.

A few design compromises are

apparent. The OnePlus 2 isn't water-resistant; it lacks a microSD slot; and the battery isn't user-removable. Then again, the Samsung Galaxy S6 doesn't have those things, yet costs twice as much.

Inside sits the latest version of Qualcomm's octa-core Snapdragon 810 processor, backed by either 3GB or 4GB of RAM, depending on whether you pick the 16GB or 64GB model. This delivers performance that's faster than you're likely to need, even if you're a mobile-gaming fanatic: it achieved single- and multi-core Geekbench results of 972 and 3,018, with an average 43fps in the GFXBench T-Rex HD test.

Although OnePlus has ditched Cyanogen OS for this edition of its smartphone, its Oxygen UI retains the "mostly pure" ethos of the first phone, running Android 5.1.1 with only minor modifications. You get a recent apps/contacts screen – called the "Shelf" – accessible with a right-swipe from the homescreen, plus a series of gestures to control the torch, camera or music player. Apart from that, it's squeaky clean.

Despite the phone's laser autofocus system, which locks onto subjects with uncanny speed, there's a momentary pause between hitting the shutter button and capture. Still, when you do grab the shot you want, photos generally look sharp and punchy: the 13-megapixel sensor is helped by an optical image stabilisation (OIS) system and wide f/2 aperture. Performance drops off in low light, with a good deal of noise obscuring detail indoors, but the dual-LED flash ensures that flash-lit subjects don't look too ghostly.

Another slight disappointment is battery life. Despite its 3,300mAh lithium-polymer battery, the OnePlus 2 lags behind rivals, consuming battery capacity at a

**LEFT** The bright 5.5in screen has a 1080p resolution – more than enough



**ABOVE** Pick from a range of finishes, including the lovely Sandstone Black version shown here



**"The OnePlus 2's display is perfectly sharp enough, unless you want to look at it under a magnifying glass – or use it as a VR headset"**

**+** Superb amount of storage for the price, great design, bags of speed  
**—** Slight lag on the camera, average battery life, difficult to buy

rate of 4.9% per hour while streaming audio over 4G (with the screen off), and 8.8% per hour while playing video in flight mode. It's not disastrous – the OnePlus 2 will easily get you through a day – but it's beaten by numerous other handsets, including the Motorola Moto G.

Still, the OnePlus 2 remains an unbeatable bargain, especially the £289 64GB version: no other manufacturer gives you this much storage for so little.

The handset will never be a mass-market success, the sales model pretty much ensures that.

To get one you need to sign up and participate in OnePlus' various online activities, be invited by another OnePlus owner, or get lucky in one of OnePlus' occasional one-hour sales. However, if you have the opportunity to get your hands on a OnePlus 2, think very seriously about taking it. **JONATHAN BRAY**

### SPECIFICATIONS

Octa-core 1.7GHz Qualcomm Snapdragon 810 v2.1 SoC • 3GB/4GB RAM • 16GB/64GB storage • 5.5in 1,080 x 1,920 IPS display • 13MP/5MP rear/front cameras • dual-band 802.11ac Wi-Fi • 4G • 3,300mAh Li-Po battery • OxygenOS 2.1 (based on Android 5.1.1 Lollipop) • 1yr RTB warranty • 75 x 9.9 x 152mm (WDH) • 175g

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## Eizo FlexScan EV2750

What, no 4K? Eizo sets its sights on building a practical monitor for the office – with predictably great results

SCORE ★★★★★

PRICE £644 (£773 inc VAT) from [eizo.co.uk](http://eizo.co.uk)

Every time a new monitor arrives on my desk, I'm asked the same questions. Is it 4K? Is it OLED? Does it do 3D? In the case of the 27in FlexScan EV2750, the answer to all of these questions is no. In terms of cutting-edge technology, Eizo's latest monitor has little to show for itself. But then this is a display that's designed for the office, and, as business monitors go, the FlexScan EV2750 is pretty special.

The first surprise is how compact it is for a 27in monitor. Sat next to my everyday display, a Dell UltraSharp U2713H, the Eizo is far less imposing. A super-slim 7mm bezel runs around the panel, and the matte anti-glare screen coating even stretches over the bezel, which is surrounded by only a millimetre-thick ring of plastic.

The monitor's angular, contoured design is impressively slender, and the adjustable stand packs in all of the essentials without swallowing precious desk space. It provides 155mm of height adjustment, in addition to a generous amount of tilt and swivel, and the whole screen can rotate into portrait mode.

Eizo has something of an image-quality reputation to uphold, and the FlexScan EV2750 does it proud. The 2,560 x 1,440 IPS panel is almost perfect, and the matte anti-glare finish provides extremely

**BELOW** The FlexScan is available in a fetching white option, as well as black



wide viewing angles with no distracting reflections.

Brightness stretches from an unusually low minimum of 1cd/m<sup>2</sup> right up to 341cd/m<sup>2</sup> – and is flicker-free due to the lack of pulse-width modulation (PWM) – while contrast reaches 935:1. Colour accuracy is superb, too. In testing, I found the factory-calibrated sRGB mode covered 98.8% of the sRGB gamut, with a low average Delta E of 1.6.

The consistency of the monitor's LED backlighting is also impressive, with only a 8.5% drop in brightness in the top-right corner, and an average variance across the screen of 3%. Colour temperature is stable, with no obvious shifts in tone. Colours look even and clean across the entire width of the display.

Along with two configurable modes, there are also pre-calibrated sRGB and DICOM (the standard for medical displays) modes and a "Paper" mode that reduces the white level and contrast for easier reading. The supplied ScreenManager Pro software provides support for circadian dimming, which adjusts the screen's colour temperature setting to suit the time of day.

If you're wondering what makes this specifically a business monitor, then the FlexScan EV2750 has a few answers. Perhaps the most useful feature is Eizo's Auto EcoView, which adjusts the display's backlight to best suit on-screen content, as well as ambient lighting conditions.

**ABOVE** As we expect from Eizo's monitors, the FlexScan delivers great image quality



**"Perhaps the most useful feature is Auto EcoView, which adjusts the display's backlight to best suit on-screen content"**

**+** Excellent image quality underpinned by lots of business-friendly features  
**—** There's only one negative: the considerable price tag.

A sensor on the lower bezel deals with the brightness, and the shifts are subtle, smooth and unintrusive. Maximum and minimum brightness settings can be tweaked to better suit the lighting conditions, too.

Eizo's EcoView Optimizer goes one step further by reacting to the content displayed on-screen and reducing the backlight brightness accordingly. For darker content, it reduces the brightness of the backlight and boosts the gain applied to the incoming image signal, ensuring that everything remains visible. This gives images a slightly washed-out effect, but it

reduces running costs. It's also possible to save the FlexScan EV2750's image and EcoView settings to an XML file and – as long as each computer has Eizo's

EvoView NET software installed – deploy them over an office network.

The FlexScan EV2750 is an excellent monitor. It's expensive compared to consumer displays, but take into account the variety of useful power-saving features, and the five-year warranty, and the Eizo goes a long way towards justifying its high price. **SASHA MULLER**

### SPECIFICATIONS

27in 2,560 x 1,440 IPS • DisplayPort • HDMI • DVI • 2 x USB 3 • 3.5mm audio out • 5yr RTB warranty • 612 x 245 x 390-545mm (WDH)





## Sony SmartBand 2 SWR12

A good choice if you want a waterproof, fit-and-forget tracker – complete with a heart-rate monitor

SCORE

PRICE: £78 (£93 inc VAT) from [amazon.co.uk](http://amazon.co.uk)

Choosing a fitness tracker in 2015 is tough. There are hundreds of products vying for your attention, from apps to specialist devices for athletes. The SmartBand 2 aims to appeal by including a heart-rate monitor in a fit-and-forget design that can even survive the swimming pool.

To be precise, it's IP68-compliant, making it fully waterproof. All of the tracking hardware, including the optical heart-rate sensor, is contained within a tiny, curved module that snaps into the rear of a soft, silicon-rubber wristband.

The band's design is attractive and minimalist, whether you choose the white or black version; pink and indigo versions are on the way. Sony has improved upon the design of the latch with the SmartBand 2, introducing a metal buckle that secures the tracker firmly to your wrist. It's comfortable to wear, too.

There's a single button on one side that switches the device on and off, snoozes alarms and performs various other tasks. It's accompanied by three status LEDs, which indicate charge, connection and mode.

That's it for physical features. There's no display for the time or for monitoring your steps. As you carry out your daily activities, the SmartBand 2 uses an accelerometer to track your steps, sleep and calorie burn, while the heart-rate monitor takes stock of your pulse at regular intervals – around six times per hour by default – and delivers its verdict on your stress levels. It does this by tracking your heart-rate variability (HRV): the steadier your heart rate, the more relaxed you are; the more variation in the time between beats, the more stressed you are.

While you're working out, you can put the



SmartBand 2 into continuous measurement mode for increased accuracy with a double-press on the device's button. Most of the time, though, you can let it be. You don't need to input whether you're running, walking or sleeping – it should be able to tell the difference and log it automatically.

I say should, because this is one of the SmartBand 2's weaknesses: it regularly made rudimentary mistakes about the type of activity I was doing. It thought I was asleep when I was sitting on the sofa watching TV, and on more than one occasion logged me "running" when I was doing nothing of the sort. I'm also disappointed to see no tracking for swimming, cycling or workouts.

There are, however, a handful of bonus features here. The first is a smart alarm that monitors your sleep patterns, only waking you when you're sleeping lightly so that you don't wake up groggy. There's also rudimentary music control. Press the button and you can tap to pause, play, and skip tracks on your phone. And the SmartBand 2 can be set to buzz when you receive phone calls, texts and other notifications.

Battery life is reasonable, charging via micro-USB in around an hour, and lasting roughly two days per charge with the heart-rate monitor enabled. Usefully, the SmartBand 2 also has a Stamina mode, which switches off the heart-rate monitor to help you eke out a little more life from the battery.

All of the data, analysis and settings are accessed through the accompanying smartphone app, and it's



LEFT The built-in optical heart-rate sensor is the star of the show

ABOVE The SWR12 is ideal for those wanting a discreet smartband

good to see support for both iPhone (iOS 8.2 or later) and Android handsets (4.4 or later). On both platforms, the SmartBand 2 app is required for connection and to view current stats, such as live heart rate, today's steps, sleep and running time, with another app taking over for historic data.

On Android, the Sony Lifelog app fulfils that duty; on an iPhone you use Apple Health. Android users who prefer to use Google Fit can also flip a switch to have tracking data automatically transferred there.

Setup is straightforward, with connection taking place almost instantaneously. There's onboard near-field communication (NFC) to help Android users connect more quickly simply by touching phone and wristband together. The apps are fairly easy to use, too, although I prefer the Android software over the iOS app. There's more information available to help you interpret your results, and the Sony Lifelog app presents your fitness data in a far more detailed and helpful way than Apple Health.

However, there appears to be little point to the heart activity mode. This monitors your pulse more frequently than when the SmartBand 2 is in background tracking mode, but

**"You don't need to input whether you're running, walking or sleeping – it should be able to differentiate and log it automatically"**

there's no way you can view these activities in detail in the software, which is disappointing.

That said, the Sony SmartBand 2 is a decent fitness tracker for the money, and delivers

more useful heart-rate data than the Jawbone UP3, which tracks your pulse only while you're sleeping. Even so, I'd expect more accurate activity tracking in a £100 fitness band, along with a greater variety of activities to track. As such, it's worth investigating alternatives such as the Fitbit Charge HR, which includes both a heart-rate sensor and OLED display, plus a set of activity-tracking options, for the same price. **JONATHAN BRAY**

### SPECIFICATIONS

Accelerometer • optical heart-rate sensor • IP68 rating for dust and water resistance • 3 x status LEDs • NFC • Bluetooth LE, iOS (8.2 or later) and Android (4.4 or later) support • micro-USB charging • 1yr RTB warranty

- Fully waterproof, easy to set up and use, automatic tracking (mostly)
- No screen, no swim or cycle tracking, not a great price

# Mobile apps

## Moodnotes

SCORE ★★★★★

PRICE £2.99



If you're already counting your daily steps, tracking sleep cycles and monitoring metrics such as food intake to body temperature, you'll be well acquainted with the idea of the "quantified self" – the notion that data-gathering can help you achieve and maintain physical wellbeing.

Thriveport's Moodnotes is a simple tracking app that extends the idea to emotional states. Created by Ustwo, the development team behind the beautiful, mind-bending game Monument Valley, its interface is very straightforward: opening the app reveals a friendly-looking graphic of a face. With a quick swipe up or down, you can match the face to your current mood. Then you're asked to log how you're feeling, on a seven-point scale from terrific joy to dire despair.

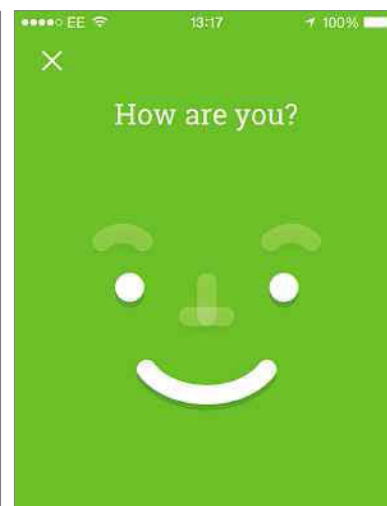
The next stage draws on techniques from cognitive behavioural therapy (CBT). If you've indicated a negative

mood, Moodnotes invites you to describe your thoughts and to consider whether you've fallen into one of 14 common "thinking traps", such as "mind-reading" (jumping to conclusions about other people's thoughts), "catastrophising" (blowing events out of proportion) or simply failing to see the positives in a situation. If you're firmly in the smiley zone, the app invites you to reflect again, in order to encourage happy-making thinking habits. You can then rescore your feelings and note whether you feel better. Once you've used Moodnotes for a while, you can use the timeline view to track how your moods have changed over time.

Beyond that there are no other features: it's pretty simple. But the intuitive interface makes Moodnotes a friendly and attractive way to track your mental wellbeing. While the app lacks an official medical endorsement, the CBT techniques it draws on are recommended by the NHS to combat stress, anxiety disorders and some types of depression.

The only question is whether it will appeal to you, which may depend on your level of faith in self-quantifying. Unlike a health-monitoring device, Moodnotes has no way to automatically detect your mood,

**RIGHT** The interface is straightforward: just swipe up or down to log your mood



**"The intuitive interface makes Moodnotes a friendly and attractive way to track your mental wellbeing"**

or to tell you what your thinking trap is – and there's no fixed schedule for using it either. To get the best out of the app, you must want to use it, even more so than a

wearable fitness device that, to an extent, does the measuring for you. Still, it's well designed and can certainly be helpful. For the low price, it's well worth a try for anyone who wants to start managing their moods. **LISE SMITH**

## Bounts

SCORE ★★★★★

PRICE Free, with in-app purchases



Having trouble getting incentivised to use all those fitness apps? Bounts to the rescue – it plugs into other fitness apps and devices including Fitbit, Moves, Jawbone, MapMyFitness, Strava, Runkeeper and more, and offers monetary rewards for your hard work.

By connecting apps, Bounts translates your workout into points – capped at 15 per day for the free app, and higher for a paid subscription. Points can then be exchanged for vouchers for brands such as Amazon, WHSmith, Tesco and iTunes. You can even undo all your good work with Pizza Express vouchers. **ALAN MARTIN**



**ABOVE** A Reward Wheel lets you spin for the chance to earn more points

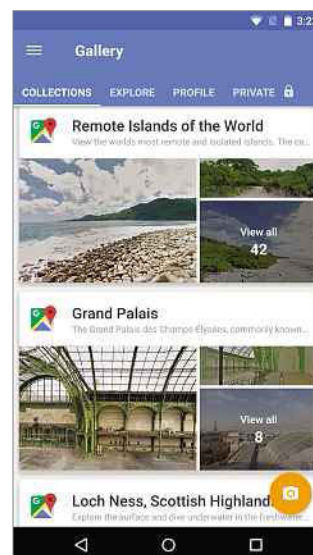
## Google Street View

SCORE ★★★★★

PRICE Free



Google's Street View gets a standalone release with this app. As well as browsing Google's own Street View images, the app lets you explore panoramic shots by users from all over the globe. If nothing else, the app is worth downloading for the tool that lets you make 360-degree photographs using your phone's camera. After you've made a 360-degree photo, you can publish it to Google Maps as a spherical image or share it privately as a flat picture. **THOMAS MCMULLAN**



**ABOVE** Explore panoramic shots taken by others

Unleash the gamer within you



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A collage of various laptops and tablets arranged around the central text. The devices are shown in different orientations and colors, including silver, black, and dark blue. Some screens display the Windows 10 logo, while others show different interfaces or are closed. The background is white with a faint grid pattern.

# Windows 10 laptops



Do you crave a new laptop now that Windows 10 is out? We put a selection of conventional laptops and hybrids to the test, with models starting from only £200

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# Buyer's guide

The laptop market has become incredibly competitive, with prices for decent machines falling to all-time lows. Here's what you should be looking for

**W**indows 10 is a second chance – it's a second chance for consumers saddled with Windows 8 to upgrade to an operating system that properly understands the difference between laptops and tablets, and yet serves both equally well. Furthermore, it's a second opportunity for the laptop manufacturers to prove that their impressive 360-degree hinges, touchscreens and tablet docking systems aren't pointless novelties.

Ten laptops that show off Windows 10's versatility are on test here. Our lineup includes the most novel, yet budget-friendly, one-size-fits-all hybrids, as well as more conventional laptops for traditionalists who want a device for work as much as mindless consumption.

The number of manufacturers has dwindled, leaving a small field of extremely powerful brands with a huge roster of laptops to sell. This process has made the market staggeringly competitive, with prices for competent laptops dropping to all-time lows. We're almost at a point where there are no "bad" laptops.

Almost. You can still bag a turkey, especially if you misjudge what you need from your laptop. The processor will have the biggest impact on what you can get done. More cores don't necessarily equate to better performance – for example, a quad-core Intel Atom processor is no match for a dual-core Intel Core i5.

## How we test

PC Pro's quantitative benchmarks complement our hands-on testing. We test performance using a set of multimedia benchmarks, producing an overall score for photo processing, video rendering and multitasking. For reference, a desktop PC with an Intel Core i5-4670K with 8GB of RAM scores 100 in each test. We analyse screen performance with an X-Rite i1Display Pro calibrator, measuring colour accuracy, brightness and contrast. We standardise battery testing with a looping video test – using flight mode to eliminate external influences.



**ABOVE** The most powerful laptops here come with dedicated graphics chips

If you're looking for snappy performance, an Intel Core i5 or i7 processor is the way to go, but with great power comes compromise. These chips are comparatively power-hungry and generate plenty of heat, so aren't always the best choice if you're often on the move without mains electricity.

**“Look out for dual-core Celerons and quad-core Atoms if you want the best battery life, but be prepared to sacrifice performance”**

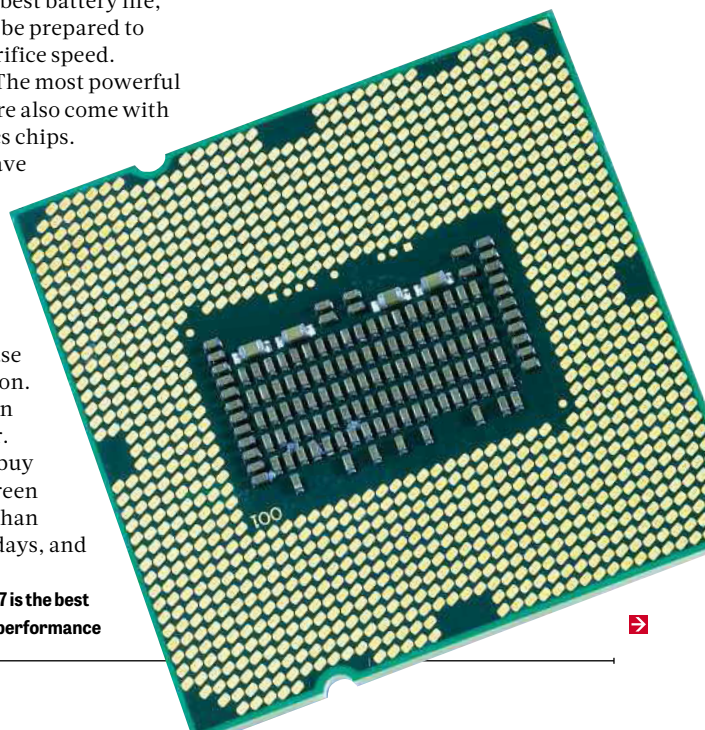
Look for dual-core Celerons and quad-core Atoms if you want the best battery life, but be prepared to sacrifice speed.

The most powerful laptops on test here also come with dedicated graphics chips. Most GPUs now save as much power as possible, but their presence when watching HD videos and playing games will, again, increase power consumption.

Don't scrimp on the display, either. It's impossible to buy a laptop with a screen resolution lower than 1,366 x 768 these days, and

this resolution actually works very well on smaller laptops, keeping the text legible without having to resort to awkward magnification. Larger laptops generally boast Full HD (1,920 x 1,080) panels, which are big enough to put windows side by side for multitasking. Full HD doesn't necessarily mean great image quality, though. Many HD panels sacrifice colour accuracy and vibrancy to cut costs.

**RIGHT** The Intel Core i7 is the best processor for snappy performance







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11 ports united by one ultra-fast Thunderbolt cable.



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Dual Thunderbolt 2 Ports

Up to 32.0TB

UP TO  
**580MB/s**  
RAID 5 SPEEDS!



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\*from domestic and foreign parts

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	Acer Aspire R 11 (R3-131T)	Asus N551JX	Asus Transformer Book T100 Chi	<b>LABS WINNER</b> Dell Inspiron 15 5558	HP Envy x360	
<b>Overall rating</b>	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆	
<b>Purchase information</b>						
Part code	NX.GOYEK.003	N551JX-DM192H	T100CHI-FG007B	210-AEDU	M1N37EA#ABU	
Price (inc VAT)	£208 (£250)	£625 (£750)	£292 (£350)	£458 (£549)	£521 (£625)	
Delivery (inc VAT) <sup>1</sup>	Free	Free	Free	Free	Free	
Supplier	pcworld.co.uk	pcworld.co.uk	johnlewis.com	dell.co.uk	ebuyer.com	
Dimensions (WDH, including feet)	298 x 211 x 21mm	383 x 225 x 32mm	365 x 175 x 15mm	380 x 260 x 24mm	382 x 250 x 24mm	
Weight (with charger)	1.6kg (1.8kg)	2.7kg (3.2kg)	1.1kg (1.2kg)	2.5kg (2.8kg)	2.3kg (2.5kg)	
<b>Service &amp; support</b>						
Warranty <sup>2</sup>	1yr RTB	2yr RTB	2yr RTB	1yr C&R	1yr C&R	
Manufacturer reliability/support score <sup>3</sup>	87% / 82%	85% / 77%	85% / 77%	83% / 73%	84% / 77%	
<b>Core components</b>						
Processor	Dual-core 1.6GHz Intel Celeron N3050	Dual-core 2.8GHz Intel Core i5-4200H	Quad-core 1.46GHz Intel Atom Z3775	Dual-core 2.2GHz Intel Core i5-5200U	Dual-core 2.2GHz Intel Core i5-5200U	
RAM fitted	2GB	8GB	2GB	8GB	8GB	
<b>Display</b>						
Size & finish	11.1in gloss	15.6in matte	10.1in gloss	15.6in matte	15.6in gloss	
Resolution	1,366 x 768	1,920 x 1,080	1,920 x 1,200	1,920 x 1,080	1,920 x 1,080	
Touchscreen (type)	Capacitive	✗	Capacitive	✗	Capacitive	
Graphics chipset	Intel HD Graphics	Nvidia GeForce GTX 950M	Intel HD Graphics	Nvidia GeForce GTX 920M	Intel HD Graphics 5500	
Video outputs	HDMI	HDMI; mini-DisplayPort	micro-HDMI	HDMI	HDMI	
<b>Drives</b>						
Storage capacity	500GB	128GB + 1TB	64GB	1TB	1TB	
Storage type	Hard disk	SSD + hard disk	eMMC flash	Hard disk	Hard disk	
Optical drive	✗	DVD/RW	✗	DVD/RW	✗	
<b>Battery</b>						
Type (capacity)	Lithium polymer (3,270mAh)	Lithium polymer (56Wh)	Lithium polymer (3,950mAh)	Lithium ion (40Wh)	Lithium ion (43Wh)	
<b>Ports &amp; connections</b>						
Wireless connectivity	802.11n; Bluetooth 4	802.11ac; Bluetooth 4	802.11n; Bluetooth 4	802.11ac; Bluetooth 4	802.11ac; Bluetooth 4	
Wired Ethernet speed (Mbps/sec)	10/100/1,000	10/100/1,000	✗	10/100/1,000	10/100/1,000	
Memory card reader	SD	SD/SDHC/SDXC	microSD	SD/SDHC/SDXC	SD/SDHC/SDXC	
Ports	3.5mm headphone jack; USB 3; USB 2	3.5mm headphone jack; 3 x USB 3	3.5mm headphone jack; USB Micro-B	3.5mm headphone jack; 3 x USB 3	3.5mm headphone jack; 2 x USB 3; USB 2	
<b>Other features</b>						
Webcam	✓	✓	✓	✓	✓	
Backlit keyboard	✗	✓	✗	✗	✓	
Touchpad toggle on/off	✓	✓	✓	✓	✓	
Volume control	✓	✓	✓	✓	✓	
<b>Software</b>						
Operating system	Windows 8.1 (free Windows 10 upgrade)	Windows 8.1 (free Windows 10 upgrade)	Windows 8.1 (free Windows 10 upgrade)	Windows 8.1 (free Windows 10 upgrade)	Windows 8.1 (free Windows 10 upgrade)	

1. Mainland UK only. 2. Parts and labour. UK mainland, unless otherwise stated. 3. Laptop reliability/support rating in reader-voted PC Pro Excellence Awards 2015. Where N/A, companies didn't receive enough feedback to be rated. See p35.



RECOMMENDED					
HP Pavilion x2		Lenovo Yoga 3	PC Specialist Sigma	Toshiba Satellite C40-C	Toshiba Satellite Radius 15
★★★★★		★★★★★	★★★★★	★★★★★	★★★★★
M4S53EA#ABU	LEN80JH002HUK	Sigma	C40-C-10K	P50W-C-10E	
£191 (£230)	£667 (£800)	£667 (£800)	£167 (£200)	£583 (£700)	
Free	Free	Free	Free	Free	
laptopsdirect.co.uk	pcworld.co.uk	pcspecialist.co.uk	toshiba.co.uk	pcworld.co.uk	
264 x 173 x 20mm	335 x 230 x 18mm	330 x 228 x 21mm	344 x 244 x 23mm	380 x 245 x 20mm	
1.2kg (1.4kg)	1.7kg (1.9kg)	1.9kg (2.1kg)	1.7kg (1.9kg)	2.3kg (2.5kg)	
1yr C&R	1yr RTB	1yr RTB	1yr RTB	1yr RTB	
84% / 77%	83% / 72%	N/A	81% / 73%	81% / 73%	
Quad-core 1.33GHz Intel Atom Z3736F	Dual-core 2.4GHz Intel Core i7-5500U	Dual-core 1.9GHz Intel Core i3-4030U	Dual-core 1.6GHz Intel Celeron N3050	Dual-core 2.2GHz Intel Core i5-5200U	
2GB	8GB	4GB	2GB	8GB	
10.1in gloss	14in gloss	13.3in gloss	14in gloss	15.6in gloss	
1,200 x 800	1,920 x 1,080	1,920 x 1,080	1,366 x 768	1,920 x 1,080	
Capacitive	Capacitive	Capacitive	✗	Capacitive	
Intel HD Graphics	Intel HD Graphics 5500	Intel HD Graphics 4400	Intel HD Graphics	Intel HD Graphics 5500	
micro-HDMI	HDMI	HDMI	HDMI	HDMI	
32GB	256GB	120GB	32GB	1TB	
eMMC	SSD	SSD	eMMC	Hard disk	
✗	✗	✗	✗	✗	
Lithium ion (28Wh)	Lithium ion (45Wh)	Lithium ion (4,400mAh)	Lithium ion (32Wh)	Lithium ion (45Wh)	
802.11n; Bluetooth 4	802.11ac; Bluetooth 4	802.11ac; Bluetooth 4	802.11n; Bluetooth 4	802.11ac; Bluetooth 4	
✗	✗	10/100/1,000	✗	✗	
microSD	MMC/SD/SDHC/SDXC	SD	MMC/SD/SDHC/SDXC	SD/SDHC	
3.5mm headphone jack; USB 2	3.5mm headphone jack; USB 3; USB 2	3.5mm headphone jack; USB 3; USB 2	3.5mm headphone jack; USB 3; 2 x USB 2	3.5mm headphone jack; 2 x USB 3; USB 2	
✓	✓	✓	✓	✓	
✗	✓	✗	✓	✓	
✓	✓	✓	✗	✓	
✓	✓	✓	✓	✓	
Windows 8.1 (free Windows 10 upgrade)	Windows 8.1 (free Windows 10 upgrade)	Windows 8.1 (free Windows 10 upgrade)	Windows 10	Windows 8.1 (free Windows 10 upgrade)	





## Dell Inspiron 15 5558

Poor battery life aside, the Dell Inspiron 15 5558 is a powerful laptop that's unbeatable value for money

**SCORE** ★★★★★

**PRICE £458 (£549 inc VAT) from**  
**dell.co.uk**

So-called “do everything” laptops are getting cheaper with every innovation from component manufacturers such as Intel and Nvidia. Dell’s Inspiron line has long been a popular choice for those on a tight budget, and this 15.6in laptop is an easy sell when it comes to the important “bang for your buck” ratio.

Your £549 buys you a dual-core (with Hyper-Threading) Intel Core i5 clocked to 2.2GHz, 8GB of RAM and Nvidia’s latest GeForce 920M graphics card. That substantial spec pushed the Inspiron 15 5558 to an overall score of 35 in our benchmarks, easing its way past the HP Envy x360 and Toshiba Satellite Radius 15, and coming second to the Asus N551JX.

The processor may only be a dual-core chip, but we never felt hamstrung by it – open as many browser tabs as you like and you’ll barely notice a stutter. That said, if you choose to keep the preinstalled McAfee LiveSafe software, you’ll find the noise of your teeth grinding growing ever louder as it interferes with programs and runs scans willy-nilly. We uninstalled it as soon as possible.

The GeForce 920M graphics card managed an average of 30.5fps in the Bioshock Infinite benchmark at Very Low settings and 1,920 x 1,080 resolution. You won’t be able to play the very latest games in Full HD, even at limited graphics settings, but this low-end chip at least gives you the option to fire up a few older titles and play newer ones at a reduced resolution, which isn’t bad for a £549 laptop.

Windows 10 (which is available as a free upgrade from the preinstalled Windows 8.1) feels responsive, and the only slight hesitancy in normal use comes from the spacious – if slightly sluggish – 1TB, 5,400rpm Toshiba hard disk.

### ■ Battery burnout

With such a strong spec for the price, there are naturally compromises, the biggest of which is the battery.

**ABOVE** The Inspiron 15’s spec is superb for a budget laptop



**“The Inspiron 15 5558 laptop is an easy sell when it comes to the important ‘bang for your buck’ ratio”**

It recorded one of the worst results of the laptops on test, managing only 3hrs 12mins of our looping-video playback benchmark before shutting itself down. This means you never feel quite as free and off the grid as you might hope, making this laptop better suited to domestic use than life on the road.

Indeed, this isn’t a particularly portable laptop at 2.3kg and 24mm thick. You can slide it into a bag, but you’ll definitely know it’s there. The grey plastic shell lacks rivals’ premium feel, and the textured lid

feels rugged, even if its dappled effect divided opinion in the office. The keyboard is a shallow and harsh plastic affair, with no backlight and little in the way of tactile feedback. The touchpad is surprisingly good for the

money, though, with Dell finally realising the importance of a pad and drivers that understand what you’re trying to do.

Ergonomically, it doesn’t have the class of the similarly specified Toshiba Satellite Radius 15, but you’ll need to shell out an extra £150 and do without dedicated graphics if you want Toshiba’s premium build quality.

With a Full HD resolution spread across its 15.6in display, working with



**1** A Full HD resolution and 15.6in diagonal means this laptop is perfect for viewing two windows side by side

**2** We're fond of the spacious touchpad, which we found extremely responsive in general use

**3** The sides of the laptop host three USB 3 ports, a full-sized HDMI, 3.5mm headphone jack, SD reader and DVD drive

two windows side by side isn't only possible, but comfortable. It's not a touchscreen, and we occasionally found ourselves reaching out in vain, but what you get instead of a glossy, grease-smears display is a matte-coated panel, which improves legibility of text and also keeps overhead lighting and sunlight from obscuring what's on screen.

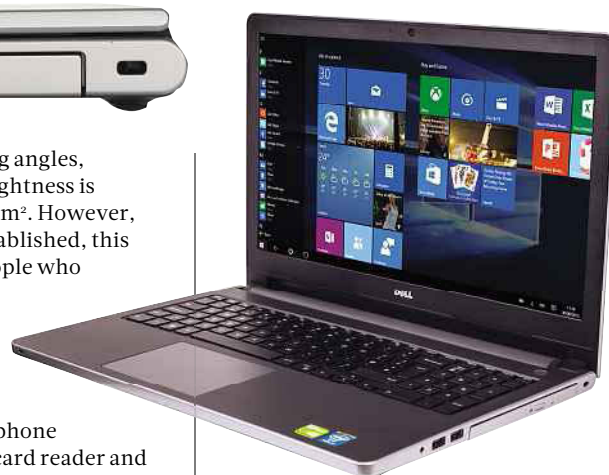
Colour accuracy is wayward – the screen can produce only 58% of the sRGB colour gamut, resulting in even the most vibrant colours looking a touch drab. Contrast is high and there's no problem

with narrow viewing angles, although overall brightness is rather dim at 210cd/m². However, as we've already established, this isn't a laptop for people who work outdoors.

Connectivity is well catered for, with three USB 3 ports, a full-sized HDMI, 3.5mm headphone

jack, an SD card reader and a DVD drive all finding a place around the edges of the Inspiron 15 5558. The speakers, which are so often an afterthought on laptops with sliced budgets, offer well-balanced

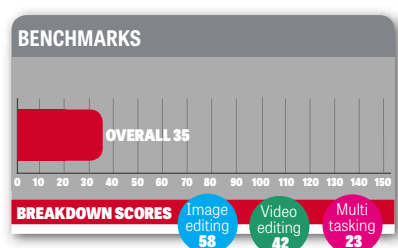
sound from both music and movies, with high-frequency dialogue and soundtrack perfectly audible. Even turned up to maximum volume, distortion is minimal. There is also the very welcome added bonus of

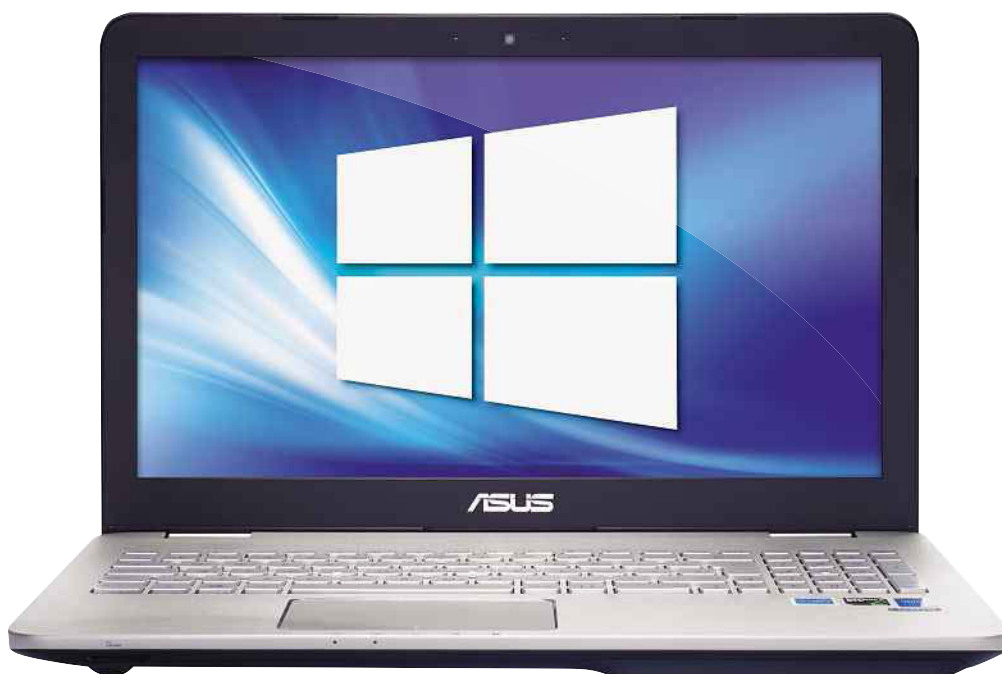


dual-band 802.11ac Wi-Fi, ensuring that you'll get maximum speed from modern routers.

Overall, the Dell Inspiron 15 5558 is the best-value laptop on test here. It doesn't hit every note, and its battery life is particularly disappointing, but if you're mostly deskbound and want a laptop that will handle work, multimedia and web browsing, nothing will beat the Inspiron 15 5558.

**"If you're mostly deskbound and want a laptop that will handle work, nothing beats the Inspiron 15 5558"**





## Asus N551JX

Great design and powerful components, but the screen mars an otherwise Labs-winning effort

SCORE ★★★★★

PRICE £625 (£750 inc VAT) from [pcworld.co.uk](http://pcworld.co.uk)

The Asus N551JX's powerful internals place it at the non-portable end of the spectrum. It's 32mm thick and weighs a wince-inducing 2.7kg, even without its large power adapter. You won't tip over backwards if you sling it into a backpack, but it will definitely alter your centre of gravity.

Despite its chunky characteristics, it's an attractive laptop with curved, swooping edges, a metal lid and a metallic keyboard tray with decorative circular patterns. You also get a dinky subwoofer to plug into the dedicated audio jack, which augments the otherwise unremarkable built-in speakers.

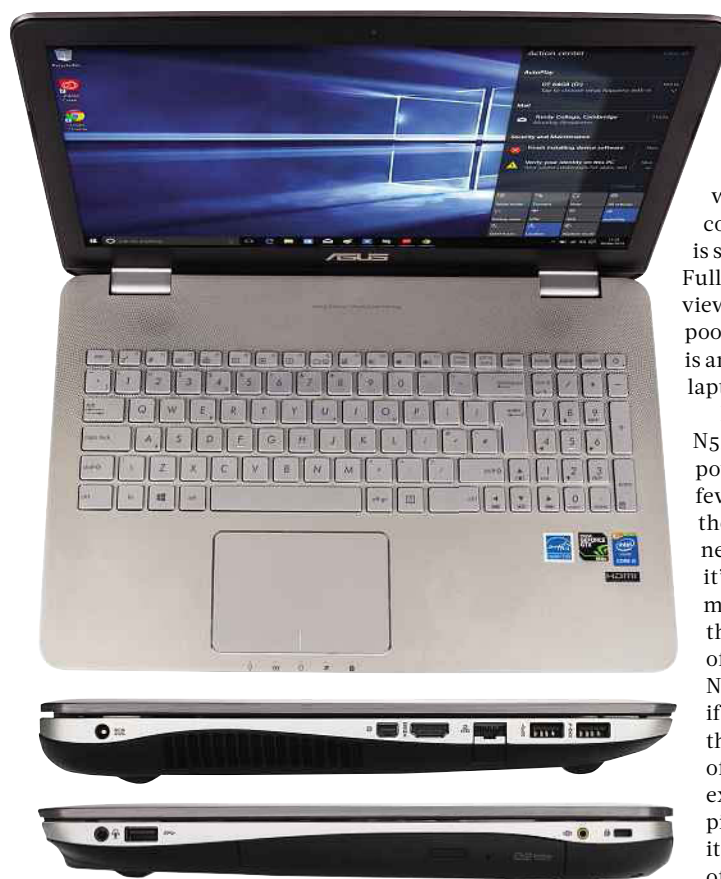
The backlit keyboard is satisfyingly chunky and offers plenty of tactile feedback, and includes a full number

**ABOVE** The Asus sacrifices portability for power

pad and set of function keys. The power button is integrated into the main keyboard, but it's harder to press than the character keys, so you're unlikely to hit it by accident, unless you're typing in a furious rage.

The fourth-generation dual-core Intel Core i5-4200H is a step up from devices with a U ("ultra low-power") suffix, with the H suffix denoting a chip with higher-end graphics and a much higher TDP. Indeed, the chip in use here has a huge

**BELOW** Despite its heft, this a stylish, well-designed laptop



TDP of 47W and a base clock speed of 2.8GHz, which can Turbo Boost to 3.4GHz, easily beating laptops with Core i5-5200U chips. With an overall score of 49 in our benchmarks, including an impressive score of 85 in the single-core image-editing test, it thrashed the competition and underlined its credentials as a power user's plaything.

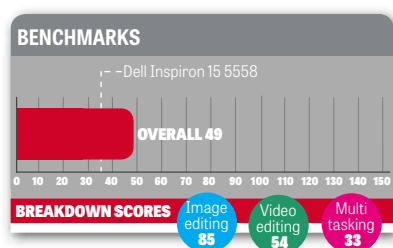
Gamers can get in on the action, too. The Nvidia GeForce GTX 950M is a mid-range mobile chip that's capable of playing the latest games at Full HD resolution, although you'll have to drop the graphical eye candy to achieve playable frame rates. Still it managed an average frame rate of 105fps in the Bioshock Infinite benchmark at Medium settings in Full HD.

Not only is the processing and graphics kit formidable, you also get 8GB of RAM and a 128GB Kingston SSD, which leaves Windows 10 (upgraded from Windows 8.1) feeling snappy when you're hunting down files using Cortana. There's also a 1TB mechanical hard disk on board for bulk file storage, giving this laptop the best of both worlds in performance and capacity.

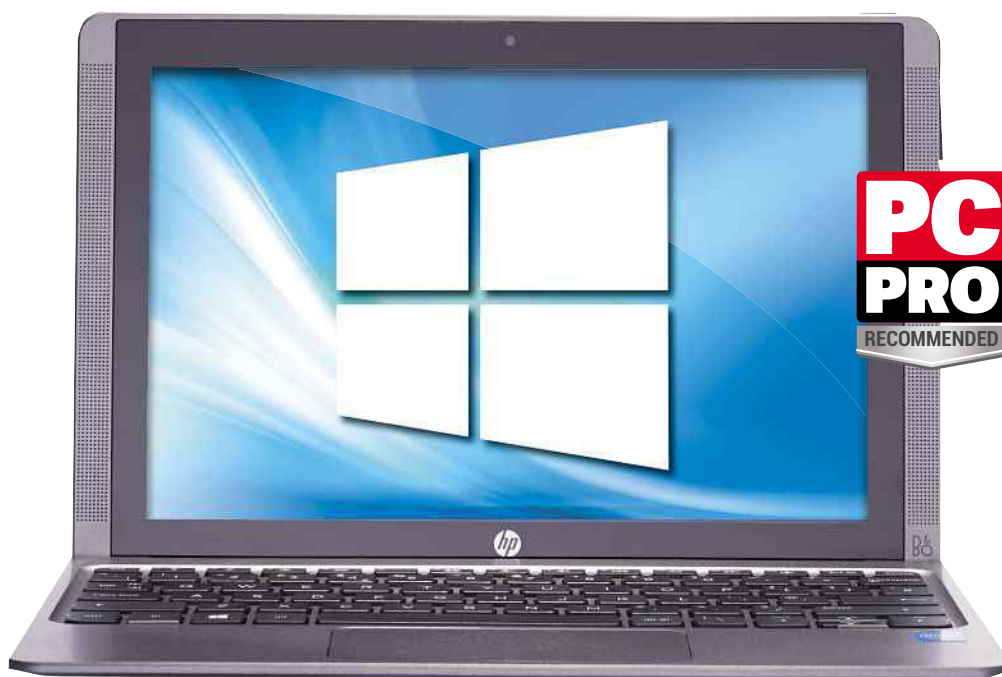
Despite the high-end components, the chunky six-cell, 56Wh battery powered the laptop through 4hrs 54mins of our looping video playback test.

When you're getting so much for £750, you begin to wonder where Asus has cut costs. Sadly, the compromise is saved for the screen. The Full HD resolution is fine, but viewing angles are particularly poor and colour accuracy is among the worst of any laptop on test here.

For only £750, the Asus N551JX is a fantastically powerful laptop with very few compromises, but if there's one compromise we never want to see on a laptop, it's the screen. What's even more galling is the fact that the displays were a strength of Asus's previous-generation N551 Series. Consequently, if you're looking for a laptop that's going to spend most of its time hooked to an external display, it's the pick of the crop. Otherwise, it falls tantalisingly short of greatness.







## HP Pavilion x2

An absolute bargain for a competent tablet and a decent laptop that combine into a single device

SCORE ★★★★★

PRICE £191 (£230 inc VAT) from [laptopsdirect.co.uk](http://laptopsdirect.co.uk)

In a group test surrounded by so many more expensive, higher-specification laptops, the HP Pavilion x2 looked to be an underdog. If it were still running Windows 8.1, this would certainly be the case.

However, with Windows 10 onboard, this sort of device is really starting to make sense, and while power users will scoff at the tiny 10.1in screen, 1.33GHz Intel Atom processor and 32GB of storage, there is now much to be said for these little hybrid devices.

It's cheap, but by no means nasty. To the naked eye, the Pavilion x2's tablet portion looks like it's machined from a single block of aluminium. In fact, it's made from several pieces of brushed silver plastic but, until you get your hands on it, you'll be none

**ABOVE** The tablet locks into place on the keyboard via a sturdy magnet

the wiser. Smooth but angular edges, delicate speaker grilles and a sturdy magnet keeping the keyboard and tablet together make for a premium-looking device.

The IPS screen is a budget-buster too. It's punchy, with a maximum brightness of 327cd/m<sup>2</sup> and 1,158:1 contrast ratio, and wide viewing angles mean you don't have to tilt your head to get a good view. Colour coverage is fairly poor, which affects colour vibrancy,

**BELOW** The IPS screen is a punchy budget-buster



but you're unlikely to do better at this price.

We were surprised to find we could get some serious work done on this machine. You can't have more than one window in focus unless you like thin columns of text, but once you combine deft swipes on the touchpad, prodigious use of Windows 10's Task Switcher and precise prods on the excellent touchscreen, you'd hardly notice you're working on such a tiny laptop. You also won't be constantly checking the battery gauge, as it lasted 7hrs 51mins in our battery test. With modest usage, you can go an entire working day without having to attach the USB Type-C charger.

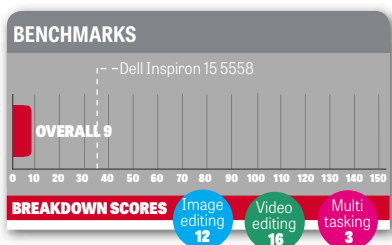
All the x2's ports are on the tablet portion – the keyboard doesn't offer any extra connectivity. Alongside the charger, there's a conventional USB 2 port, a microSD card slot for expanding the device's paltry 32GB of eMMC flash storage, as well as a 3.5mm headset jack. Despite the Bang & Olufsen speaker branding, there's no bass whatsoever and it doesn't even seem as if the audio is coming out of the front-facing grilles.

Performance is surprisingly sprightly. The quad-core processor does a decent job, but much of

the credit should go to a combination of Windows 10's massively improved gestures and the clever rendering techniques of the Edge web browser. Load up *The Guardian's* image-heavy homepage using Google Chrome and you'll notice things slow to a judder as you attempt to scroll up and down. Edge capably handles what matters first, loading text and then images, while keeping the scrolling action smooth and predictable.

Our more challenging multimedia benchmarks don't paint such a pretty picture, with a deathly overall score of 9. It must be said, however, that an Intel Atom processor was never intended to render 4K videos.

The HP Pavilion x2 definitely lacks oomph, but it's one of the best budget hybrids you can buy today. Set aside the paltry storage and iffy speakers, and you have an effective laptop and a decent tablet, which is quite something for £230.





## Toshiba Satellite C40-C

It lacks power and you don't get complimentary Office 365, but it's still an effective laptop

SCORE ★★★★★

PRICE £167 (£200 inc VAT) from [toshiba.co.uk](http://toshiba.co.uk)

The netbook is well and truly back, with the HP Stream 11 representing the best-value Windows laptop you can buy. Not to be outdone, Toshiba regularly shows off what it calls Cloudbooks, which are super-cheap netbook-style devices that assume you will store all of your files in the cloud instead of locally.

Sadly, the offer of a year's free Office 365 is absent, something both HP and Asus were able to do last year. Still, what you get with the C40-C is a large, light laptop with bargain-basement components for an almost offensively low price – and it's not half bad, either.

Despite being cheaper than the HP Pavilion x2, you get an extra four

**ABOVE** The C40-C's 1.7kg weight makes it very portable

**BELOW** Build quality is impressively solid for the price

inches of screen – 14in in total – and an improved 1,366 x 768 resolution. Text and images have room, so everything feels a little more comfortable. There aren't quite enough pixels to fit two windows side by side and work effectively in both, but you could snap a Twitter feed or other column-based apps to the left or right of your screen and still have room to work on

a document. The screen has a glossy coating, which does suffer a little under the scorching British sun. However, on those rare cloudy days, it's perfectly usable, even if you're trying to save power by turning the brightness down.

You won't need to be too proactive with your battery saving, though, as the dual-core 1.6GHz Intel Celeron N3050 only sips at the battery even when you're pushing it to the limit, with a maximum TDP of 6W. We recorded a score of 7hrs 16mins in our looping-video battery test, and we achieved even better results with non-media tasks. This, plus the C40-C's 1.7kg weight, makes it a superb companion on the road, and a worthy second device if your home laptop is too bulky to travel.

Build quality is impressive for the price, with a stylish black, brushed-metal-style texture on the keyboard tray and lid. It feels solid, although if you push hard enough you will see the plastic flex. The keyboard is responsive, if not particularly satisfying, while the touchpad and attached buttons are sensitive and willing to obey various multi-

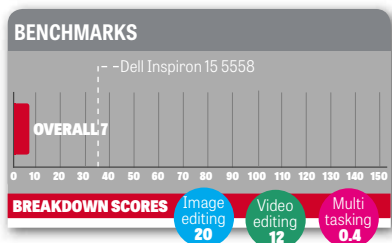
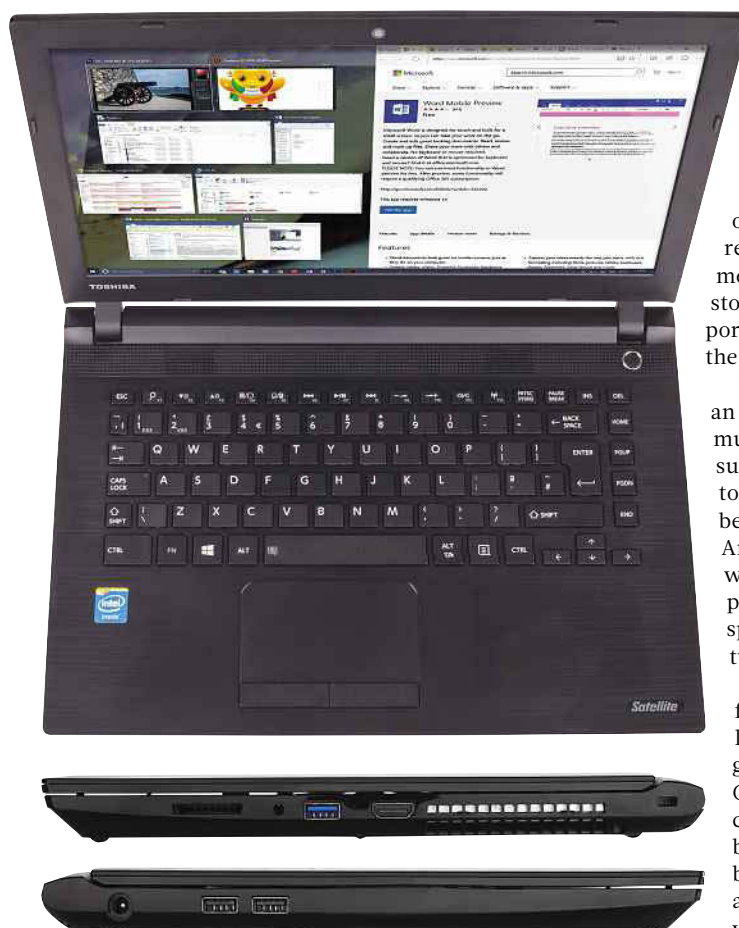
fingered gestures, such as scrolling with two fingers.

You get only one USB 3 port and two more USB 2 connectors for peripherals, along with a full-sized HDMI output and an SD card reader to supplement the meagre 32GB of built-in storage. There's no Ethernet port, so you'll have to rely on the single-band 802.11n Wi-Fi.

Of course, you don't get an awful lot of grunt for multimedia tasks with such a low TDP, as our tough photo and video benchmarks prove.

An overall score of 7 is a warning to those who edit photos in the field – you'll spend an awful lot of time twiddling your thumbs.

If you're in the market for a budget laptop for lightweight work on the go, the Toshiba Satellite C40-C merits serious consideration. It may not be powerful, but its long battery life, decent build and near-unbeatable price will win over many.





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# A guide to upgrading from Windows 8.1 to Windows 10

Upgrading to Windows 10 isn't an error-free process. We take you through the key checks and tweaks you should make on your new (or old) laptop

Even if you buy a new laptop now, you're not guaranteed to find Windows 10 preinstalled. Instead, you may get Windows 8.1 and find stickers on the box and the laptop itself telling you that you're entitled to a free upgrade.

The timing of Windows 10 was always going to be awkward for manufacturers, because Windows 10 was launched well after many of the bigger companies released their new laptop ranges. With the number of units sitting on container ships and in warehouses, it's impossible to upgrade those laptops already out in the wild, so they make it into consumers' hands without Windows 10.

You have until 29 July 2016 to upgrade your laptop to Windows 10 for free. After that point, you will have to pay the full retail price for Windows 10, which currently sits at around £80 for the Home edition.

Around half of our review units came with Windows 10 already preinstalled, but this is because the companies in question manually upgraded them to Windows 10 before they were dispatched to us. The other half we upgraded ourselves. The exception here is PC Specialist, which supplies its Sigma laptop with Windows 10 straight out of the box.

## ■ Ready, set, Start!

You can begin to prepare your new laptop for Windows 10 before it has even left the warehouse. Aside from backing up your files to an external hard disk, the cloud or a NAS, you can also prepare a USB flash drive with a Windows 10 installation.

This is something we'd highly recommend doing, as it will speed along the upgrade process when your new laptop does eventually arrive. Full instructions are available from [pcpro.link/254windowsupgrade](http://pcpro.link/254windowsupgrade).

If you don't do the above, you can still undertake a fairly seamless upgrade when you first switch on your PC. As long as you've connected your laptop to an internet-connected network when you first switch on, you'll be given the option



**ABOVE** You can claim your free upgrade until 29 July 2016

to upgrade immediately. This will add a lot of time to the installation process, as you'll first have to wait for a 2.7GB file download and then run a second installation process. If you've already prepared an upgrade USB drive, you can skip this and upgrade once you've made it to the Windows 8.1 desktop.

**RIGHT** You will almost certainly need to upgrade from Windows 8.1



## ■ In the driver's seat

While our upgrades to Windows 10 went fairly smoothly, using the USB method outlined above, we did find one occasion where an out-of-date driver caused problems. You can read more about our touchpad dramas with the Acer Aspire R 11 on p88, but the lesson here is that even if your PC is apparently supported by the manufacturer, sometimes third-party drivers (in this case, Synaptics') aren't quite ready.

In more extreme cases, you may be missing a driver entirely. You can check whether crucial drivers are missing by heading to Device Manager, which you'll find in the context menu that appears when you right-click the Start button. Device Manager automatically shows (highlighted with a yellow triangle) hardware that it doesn't recognise or is missing a driver. Common culprits are wireless chips, touchpads and graphics.

Many of the big-name makers have bespoke update utilities. These are

easy to ignore as they blend into the other bloatware they insist on installing, but this sort of software can be useful as it automatically locates and downloads the latest drivers for all the components in your PC. While you're going through programs and features, uninstalling unwanted software, be sure to leave your manufacturer's update tool alone. If you don't have one, the manufacturer website should have download pages for all the drivers you might need.

## ■ Quick fixes

Aside from showstopping driver problems, there are other minor changes you'll want to make so that everything runs smoothly. One interesting side effect of Windows 10's new features is massively prolonged boot times on laptops that had Windows' "Fast Startup" setting enabled. We didn't find this affected our review laptops, although this might have something to do with the fact we didn't use them with Windows 8.1 and upgraded them immediately to Windows 10.

If you're subjected to a long black screen on startup but can still see your cursor and move it around, try switching off Fast Startup, which can be found in Advanced Power Settings | Choose What The Power Button Does. Then switch your laptop off and on again (not restart) and, in most cases, the problem should be fixed. You can turn Fast Startup on again for quicker boot times in future.

## Is your old laptop ready for Windows 10?

Newer laptops are always going to be better supported than older models, although if you're not yet prepared to ditch your current laptop, you should check the manufacturer's website to see if it's been tested for Windows 10. This is well worth doing; you'll no doubt know somebody who upgraded their ageing laptop to Windows 10 only to discover that everything from the touchpad to the wireless drivers was non-functional.

Dell has included a complete list of devices tested with Windows 10. It's not necessarily exhaustive, but the laptops that have definitely got the thumbs up are listed at [pcpro.link/254dellupgrade](http://pcpro.link/254dellupgrade)

Lenovo has also drawn up a list of the devices that officially support Windows 10: [pcpro.link/254lenovoupgrade](http://pcpro.link/254lenovoupgrade)

Acer's list tells you which devices are

eligible for Windows 10, although it's worth nothing that Acer's model numbering and SKU system is very confusing, so not every device that's actually supported will be listed at [pcpro.link/254acerupgrade](http://pcpro.link/254acerupgrade)

Toshiba has a list of devices that, when updated with the latest drivers, are compatible with Windows 10: [pcpro.link/254toshibaupgrade](http://pcpro.link/254toshibaupgrade)

Asus lets you enter your model number to see if it's compatible. Additionally, this page has a list of Asus-exclusive software that may require updating after the Windows 10 installation and various useful FAQs: [pcpro.link/254asusupgrade](http://pcpro.link/254asusupgrade)

HP also lets you enter your model number to check if it's compatible: [pcpro.link/254hpupgrade](http://pcpro.link/254hpupgrade)

**"There are teething problems to be dealt with and not every upgrade will go smoothly, but things are looking bright"**

You can also make privacy tweaks to stop Windows 10 from phoning home at every opportunity. Bear in mind that tinkering with privacy options will stop

some Windows 10 features from working (such as Cortana, location and Wi-Fi Sense). However, if you want Windows 10 but don't want your data to be shipped off to Redmond you can switch it all off.

If you find that you still have a persistent and horrible driver issue or other intractable problem

after installing Windows 10, you have a month to go back to Windows 8.1 from the date of installation.

As our glowing five-star review of Windows 10 will attest (see issue 251, p60), the new operating system is an upgrade in every sense of the word. Of course, there are teething troubles to be dealt with and not every upgrade will go smoothly. Once we've passed this awkward period of Windows 10 being an upgrade instead of coming as standard, though, things are looking bright.

**BELOW** The new OS is an upgrade in every sense of the word







## Acer Aspire R 11 (R3-131T)

A great-looking budget convertible, but Windows 10 driver problems are a showstopper

SCORE ★★☆☆☆

PRICE £208 (£250 inc VAT) from [pcworld.co.uk](http://pcworld.co.uk)

Ruggedness is an oft-forgotten but important part of a laptop. If you take your computer with you every day, it needs to be able to withstand a few knocks. That's why the colourful shell on the Acer R 11 is more than just a fashion statement.

While our unit came "Cloud White", there is also a "Sky Blue" model available, and both look great. The textured lid doesn't have any give or pick up greasy marks. The rest of the laptop is inflexible and gives you the confidence to chuck the machine around without fear.



The screen isn't half bad, either. While its low contrast levels and 1,366 x 768 resolution are drawbacks, viewing angles are excellent and it uses Corning Gorilla Glass to keep it scratch-free. Flip the laptop around and you have an effective, if weighty, tablet. The speakers are loud, crisp and avoid distortion with loud music.

**ABOVE** The Gorilla Glass screen has great viewing angles

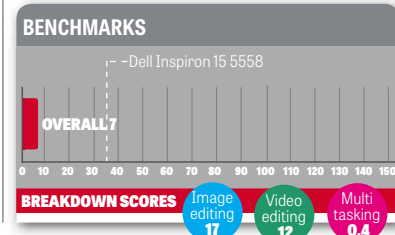
**BELOW** The inflexible lid can withstand a few knocks



Performance isn't bad, but the dual-core 1.6GHz Intel Celeron N3050 is a processor that you'll typically find in cheaper laptops. While the extra £40 has gone on clever hinges and a touchscreen, it's disappointing that we don't have more grunt. But a time of 8hrs 26mins in our battery test is a welcome by-product. The 802.11ac Wi-Fi is also a good addition, and helps explain the higher price.

However, there were real problems during the Windows 10 installation. A Synaptics driver issue hindered the drag-selection of objects, with a beep accompanying each error. This made the laptop impossible to use at times. A new driver mostly solved things, but not completely. The device is adorned with a "Windows 10 NOW" sticker – but "Windows 10 NOT QUITE YET" would be more suitable.

Until such issues are rectified, the Toshiba Satellite C40-C is a better bet.



## Asus Transformer Book T100 Chi

Unexplained design idiosyncrasies hold back this otherwise charming two-in-one

SCORE ★★☆☆☆

PRICE £292 (£350 inc VAT) from [johnlewis.com](http://johnlewis.com)

Every device here comes with compromises. Unless you're willing to pay £1,000 or more, you aren't going to be able to tick every single box. However, in the case of the Asus Transformer Book T100 Chi, the compromise is a series of design decisions that we can't make head nor tail of.

The keyboard and the screen, despite being physically attached by two magnetic prongs, only actually interface over Bluetooth. This causes two problems: the keyboard will eventually run out of battery, and when it does, you'll need to charge it separately from the tablet using a micro-USB connector. Second, there



are no USB inputs on the keyboard section. This would be fine if there were ample inputs on the tablet itself, but there aren't. There's a microSD slot to extend the tablet's 64GB of storage, and a USB micro-B connector, for which no adapter is supplied in the box at purchase – which is a bewildering decision and means you can't connect conventional USB devices without an adapter. When was the last time you saw a peripheral with a micro-B connector?

**ABOVE** The keyboard only connects via Bluetooth

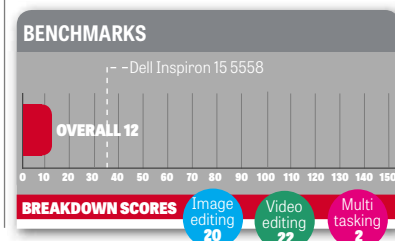
**BELOW** You need an adapter to connect USB devices



This 10.1in tablet and laptop hybrid is an otherwise excellent little device. It has one of the best screens of any of the devices on test here, with an astoundingly bright backlight, decent contrast levels and very commendable colour accuracy. The diminutive touchpad is satisfyingly responsive, while the admittedly cramped keyboard is also perfectly usable.

Performance is fine, too. The quad-core 1.46GHz Intel Atom Z3775 is a handy little low-power chip that keeps the tablet feeling sprightly with moderate usage, although battery life in our video playback benchmark was the worst on test, at only 2hrs 56mins.

Its design idiosyncrasies, micro-B connector and very short battery life severely hamper the Transformer Book T100 Chi, spoiling a machine that otherwise has the makings of a very promising two-in-one hybrid.





## HP Envy x360

An improvement on last year's Envy, but it doesn't do enough to stand out in this company

SCORE ★★☆☆

PRICE £521 (£625 inc VAT) from ebuyer.com

At first glance, little has changed on HP's Envy x360 from last year's model. There's the same faux-aluminium chassis, silver keyboard and black bezels around the screen, and the device remains a 15.6in hybrid with a 360-degree hinge.

But instead of just rebadging the 2014 model and hoping the promise of Windows 10 will sell a few more units, HP has made subtle and obvious design changes to keep things fresh. There are the slightly creased and slanting edges of the keyboard tray, sharply cut edges near the screen hinges, and some of the buttons and ports have moved.



The Touch Zone concept, a rubbish touchpad intended to make Windows 8 gestures easier, has been scrapped in favour of a traditional touchpad that actually works as expected. The keyboard remains the chunky, backlit affair it always was, although it's not as good as the keyboard on the Toshiba Satellite Radius 15, which has a grippier surface and much more pleasing tactile feedback.

ABOVE The screen can be pushed back until it's almost flat

BELOW The Envy x360 is still no lightweight at 2.3kg

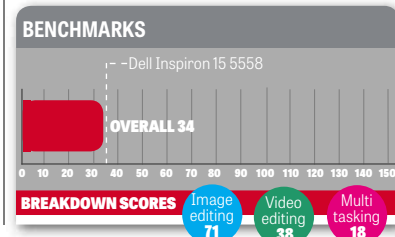


It's still no lightweight at 2.3kg, limiting the usefulness of its design – although pushing the screen back until it's almost flat makes the machine more flexible in a range of seating positions.

The touchscreen is responsive and happily complements the touchpad, but we found its colour accuracy and brightness lacking, whereas the Toshiba Satellite Radius 15 is brighter and can display more vibrant colours.

You get a dual-core 2.2GHz Intel Core i5-5200U processor, 8GB of RAM and a 1TB hard disk. Overall performance is admirable, with the Envy x360 scoring 34 opposed to the Toshiba's 30. Sadly, the battery life doesn't compare – the HP lasted 4hrs 52mins versus Toshiba's 5hrs 48mins.

It's £75 cheaper than the Radius 15, but the Toshiba has a better screen, keyboard and battery, meaning the 2015 Envy fails to live up to its name.



## Lenovo Yoga 3

A limber 14in hybrid with a potent specification – but touchpad and performance setbacks leave a bad taste

SCORE ★★☆☆

PRICE £667 (£800 inc VAT) from pcworld.co.uk

At first glance can leave a lasting impression, which is a shame, because a first glance at the Lenovo Yoga 3 could put you off for life. The aluminium lid is as insipid as they come, but that's hugely misleading: once you open the lid, the black brushed-metal chassis and backlit keyboard look a world away from the dull exterior.

This 14in hybrid isn't exactly unwieldy at 1.7kg, but when you swing the lid around to use the Yoga 3 in tablet mode, you'll soon find yourself looking for a surface on which to rest it. It's impressively thin at only 18mm, and feels every bit like an £800 laptop.

In this top-end model, you get a dual-core, Hyper-Threaded 2.4GHz



Intel Core i7-5500U, 8GB of RAM and a 256GB SSD, which is generous for the money and the weight of this device.

Given the processor's confined chassis, we weren't expecting exceptional benchmark results. We were, however, expecting better performance than the overall score of 33 that it eventually racked up. That puts it a point or two behind the Core i5-5200U-wielding HP Envy x360 and Toshiba Satellite Radius 15. What the benchmarks don't tell you, though, is that in a sprint – opening programs

ABOVE The interior is a world away from the dull exterior

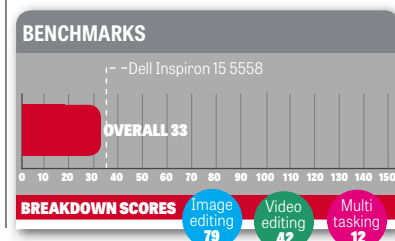
BELOW The Lenovo Yoga 3 feels every bit like a £800 laptop



and web pages – the Yoga 3 blitzes the competition. It's only in sustained use that it has to throttle back. Plus, battery life of 6hrs 53mins was one of the better results from this group test, putting it ahead of the Toshiba and HP convertibles.

The combination of a Full HD resolution and IPS panel means images look crisp and colours are consistent from every angle. Contrast hits an impressive ratio of 1,193:1, but brightness tops out at a paltry 240cd/m² – not much better than we'd expect from a budget laptop.

Elsewhere, the touchpad is infuriatingly unwilling to activate the two-fingered scrolling gesture, and the touchscreen has a nasty habit of detecting two fingers instead of one, which can lead to unexpected zooming in. It's well built and the specification is mouth-watering, but hampered performance and that ghastly touchpad keep the Yoga 3 from any kind of recommendation.





## PC Specialist Sigma

Decent performance does little to ease touchpad and other design frustrations

SCORE ★★☆☆☆

PRICE £355 (£426 inc VAT) from  
pcspecialist.co.uk

There's nothing more infuriating than a touchpad that refuses to behave in the way you expect. We experienced this frustration when we started using the PC Specialist Sigma, because it ruins an otherwise respectable 13.3in laptop.

The touchpad feels like you're using your laptop while slightly drunk. Every swipe is delayed by just enough time to make it infuriatingly hard to accurately place the cursor, and no amount of driver adjustments helped us with our woes. Prodding the 13.3in Full HD touchscreen (a decent performer) provided some light relief, but there are precision tasks, such as



selecting text, where a touchscreen simply isn't an adequate substitute.

The laptop's design is plain, but not unattractive, with a grey brushed-aluminium-style lid and a cheap, shiny plastic wristrest. It's not light, though, with its 1.9kg bulk becoming particularly apparent if you spin the device into tablet mode.

**ABOVE** The Sigma's design is plain, but not unattractive

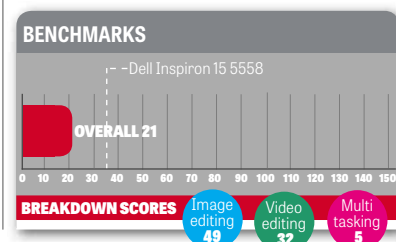
**BELOW** The 1.9kg weight is apparent in tablet mode



The keyboard is perfectly fine. It's mounted on a flexible piece of plastic, but there's lots of tactile feedback and it's not too noisy. Sadly, the keyboard is a liability when you flip the laptop on its flexible hinge – it takes a full three seconds for the drivers to click into gear and disable the keyboard.

That said, you get a snappy-feeling laptop, thanks to a dual-core 1.9GHz Intel Core i3-4030U processor, 4GB of RAM and a 120GB Kingston SSD, which produce speedy loading times for web pages and applications, and an overall score of 21 in our benchmarks. It can also be customised up to an Intel Core i7, and you can add more storage and RAM. Battery life was average, with the video-rundown test finishing the Sigma off in 3hrs 56mins.

Despite its problems, the PC Specialist Sigma offers decent value. Sadly, in the 360-degree hinge form factor, it isn't one we can recommend.



## Toshiba Satellite Radius 15

A great screen, premium build quality and long battery life make the Satellite Radius 15 a great buy

SCORE ★★★★★

PRICE £583 (£700 inc VAT) from  
pcworld.co.uk

The only place we've ever found a 15.6in 360-degree hinged laptop useful is on an aeroplane tray table or in bed. Yet there's plenty more to like about the Satellite Radius 15, beyond those arguably niche use cases.

The Radius 15 is one of the best-looking laptops that Toshiba has produced in a long time, with subtle styling tweaks lifting the Japanese company's mid-range laptop firmly into premium territory. A grippy, backlit keyboard, a very sensitive touchpad and a bright, Full HD IPS touchscreen all combine to make the Radius 15 a terrific laptop for working on. You'll rarely find anything that



looks or feels better for the reasonable price of £700 inc VAT.

A 1TB mechanical hard disk will easily eat up all of your biggest files, while three USB ports (including two USB 3), an HDMI port and an SD card reader keep the Satellite in line with its biggest rivals.

Impressively, Toshiba has managed to set the speakers in such a way that sound radiates from both the top and the bottom of the chassis, meaning you get the same audio quality whatever position it's in. Sadly, that audio quality isn't

**ABOVE** The Full HD IPS touchscreen is perfect for work

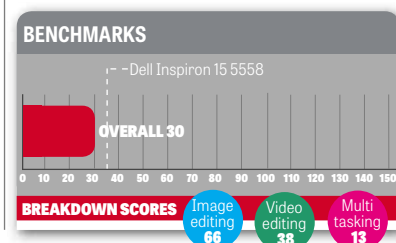
**BELOW** It has three USB ports, an HDMI port and an SD reader



particularly impressive to start with, and the process of actually hoisting the laptop into a position with the screen front-and-centre is difficult because it weighs a hefty 2.3kg. The hinge itself is both sturdy and easy to move when you need it, which is exactly what you need in a flexible laptop.

The dual-core 2.2GHz Intel Core i5-5200U, coupled with 8GB of RAM, posted an overall score of 30 in our benchmarks. Furthermore, the battery has decent stamina and lasted 5hrs 48mins in our test, which could get you through a full day if you switch on all the power-saving options and stick to only essential tasks such as light work.

The Radius 15's nearest rival in this test is the HP Envy x360, which is around £75 cheaper. However, with better battery life, a more attractive design, a superior screen and comparable performance, the Radius edges ahead of HP's laptop in our reckoning.



# View from the Labs

Windows 10 makes sense of hybrid devices, says **Michael Passingham**, but it's hard to see where manufacturers can go next

Windows Vista saw the arrival of the netbook, Windows 7 heralded the arrival of the Ultrabook, and Windows 8 saw tablets and hybrids take to the stage. So what new hardware has Windows 10 ushered in? So far, not much. But that's no bad thing. In fact, I've been impressed with the level of refinement I've seen from all parts of the laptop sector. Netbooks running Windows 10 feel snappy, Ultrabooks are classier than ever and hybrids – which I've tested several of here – feel genuinely usable and finally suited to the touchscreen form factor.

A super-cheap tablet/laptop hybrid is now a genuine alternative to owning an Android tablet and a laptop. If you do minimal work at home and want something to check Facebook on while watching TV, or a device on which to watch Netflix in bed, Intel Atom chips and Windows 10 finally have you covered.

It's not only the bottom end of the market that has impressed. In the mid-range, manufacturers are starting to concentrate on refined designs that give their hybrids and laptops a unique identity and a premium feel. For laptops



**Michael Passingham** is the laptops expert for our sister site [expertreviews.co.uk](http://expertreviews.co.uk)

**“In the mid-range market, manufacturers are really starting to concentrate on refined designs that give hybrids a premium feel”**

costing £600 or less, this is seriously impressive.

This really matters for Microsoft. The laptop industry has been eaten away by tablets, with consumers keeping their creaking Windows laptop and buying a new slate instead. Windows is finally a viable option for tablet buyers, not only because of the OS's interface but due to the creeping increase in performance from bottom-end processors.

However, it's not very clear where the laptop industry can go next. My feeling is that passively

cooled, ultra-low-power chips, such as Intel's Core M processors, will creep their way into budget laptops in the next couple of years. This means smaller, lighter kit for less money than ever

before, but with the performance you'd expect from a Core i3-powered laptop that costs £400 today.

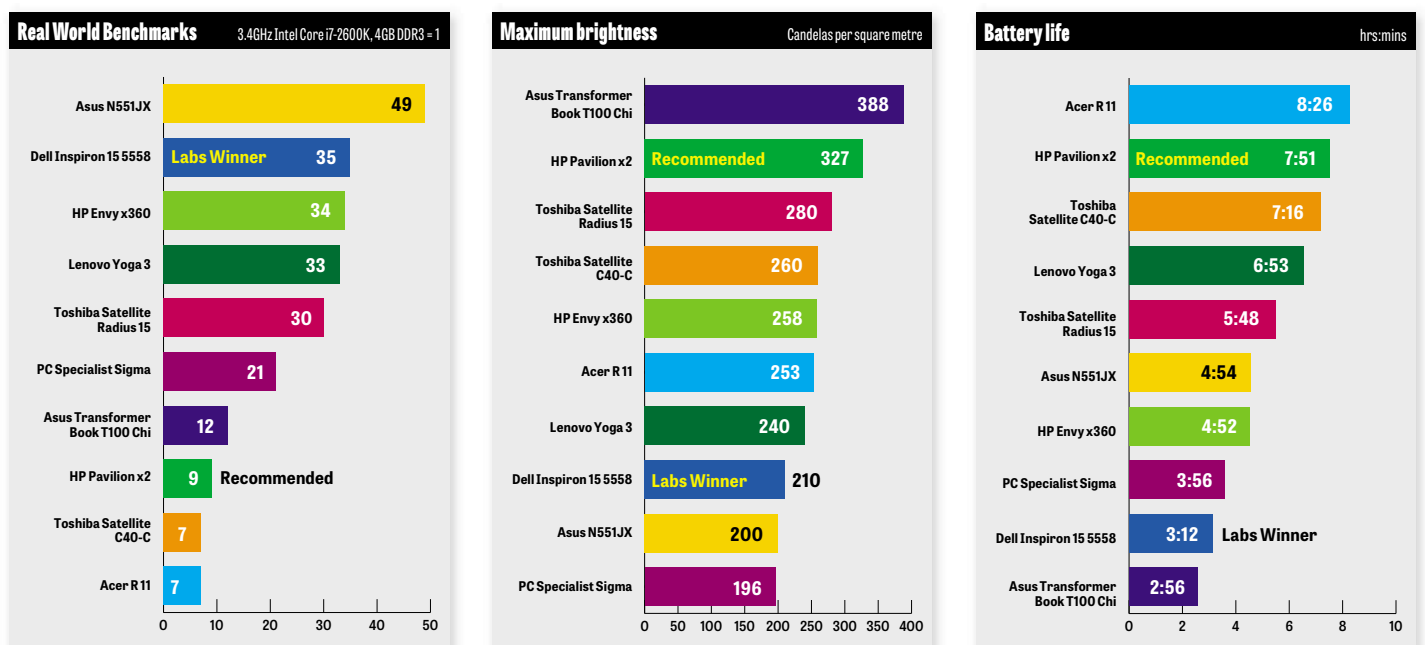
Chromebooks are still a threat to Windows 10, with their lightweight operating systems and sub-£200 price making them hugely attractive in retail. Microsoft appeared to be



countering that elegantly by bundling 1TB of OneDrive storage and free subscriptions to Office 365 with low-end Windows 8.1 devices, but that offer appears to have expired, which make some of the 32GB laptops look a little barren. However, with OneDrive and Microsoft's other online services now fully integrated into Windows 10, expect to see more of a push for cloud services.

Microsoft isn't the only player in this market any more, but that's great for innovation, competition and, ultimately, the consumer. If anyone tells you the iPad Pro is going to kill off the Windows laptop, send them my way. ●

## Test results





# The Network



Practical buying and strategic advice for IT managers and decision makers

## Business Focus

Enterprise-grade software to protect your vital data **p92**

## The Business Question

How can your company make the most of remote working? **p104**

## Cheat Sheet

The legal issues surrounding data sovereignty **p108**

## BUSINESS FOCUS

# Choose the right backup software for your business

Your digital assets are crucial to your business. **Dave Mitchell** tests the software that can protect them from disaster



Most small businesses rely entirely on IT for their everyday operations, and those that don't back up their precious company data are taking an appalling risk. It can't be due to a lack of backup solutions, because there's a wide range of versatile products available.

That's good news, seeing as no two businesses have the exact same requirements. Professional-grade backup software can be tailored to suit a wide range of scenarios, and many packages offer a modular design, so you can pick and choose the features you need.

We've previously reviewed hardware backup appliances and cloud backup services, but these tend to dictate your backup strategy to you. A key advantage of local software solutions is that they place total control in your hands, letting you decide how, when and where to secure your data.

This month, we test four network backup products from providers big and small – Arcserve, Veritas, NovaStor and Iperius. Each offers a wide range of features, with prices to suit different budgets. We examine their pros and cons to help you make the right decision for your business.

## Design for life

A complicated data-protection strategy that relies heavily on human intervention is guaranteed to fail. Your backup system must be fully automated, so look for software that provides full scheduling features, allowing it to run jobs regularly for you. Most will do this, and also handle a mixture of full and partial backups for each system to improve speed and space efficiency. Full backups are self-explanatory, while partial backups come in two main varieties: incrementals and differentials. Incremental backups only copy data

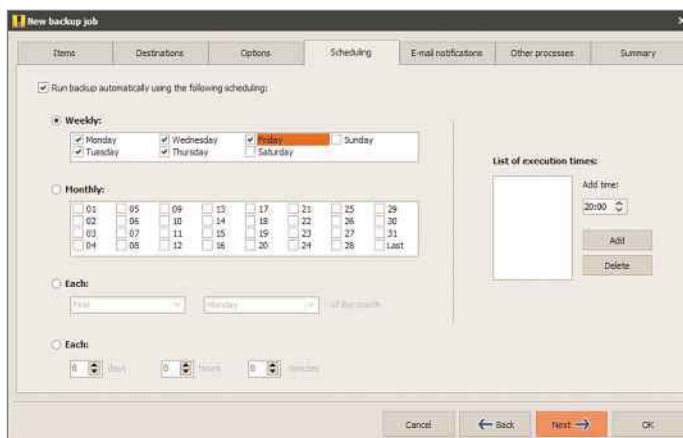
that has changed since the last full backup was run, while differentials copy all new and changed data since the last full backup. These take up more space, but they're faster to restore, as you only need apply the last full and differential backups.

If you want to minimise your backup storage, deduplication is another feature worth considering. This technology analyses data during the backup process, and if it finds multiple copies of a particular data block (for example, if you're backing up several copies of the same file), it stores only one copy. This can

yield big storage savings. Arcserve Backup is the best choice for deduplication: the feature is included in the base price, and integrated into the main product. To use it, you just run a special deduplication backup job.

It's also crucial to consider whether you want automated backup of workstations as well as servers. It makes sense to do this for most businesses, as it means you don't need to rely on end users to look after important files.

**BELOW Iperius Backup provides a handy scheduler so you can automate all your backup tasks**



## Device support

Setting up a local backup regime isn't just about the software: choosing the right devices to store your backups is critical. If you're securing data on multiple network systems, NAS appliances or disk arrays are a top choice for front-line protection.

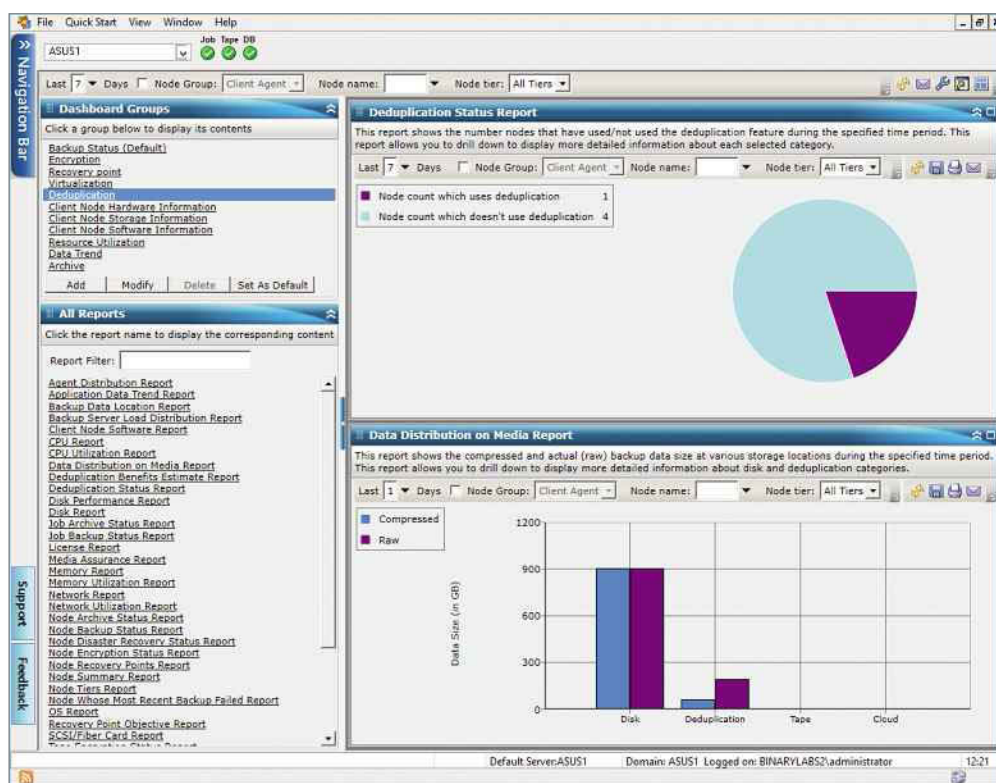
You can store all your backups on one device for easier management – plus fast local restores – but make sure you choose one that can be easily expanded to keep up with demand. All good backup products support network shares and IP SANs, but the more sophisticated ones also provide centralised device management.

Don't rely on a single on-site copy of your data, as this won't protect you against disasters such as fire or flood. Extra copies must be maintained in a secure off-site location. A few products have a staging feature, meaning they'll run an on-site backup and automatically schedule further copies to a remote site, cloud storage provider or tape drive.

On the subject of tape – although this is an old technology, it can still play an important role for long-term data archiving. We recommend Linear Tape-Open (LTO), as it's the only format still being actively developed, and is supported by most backup software. LTO got Google out of a very sticky Gmail-related situation not so long ago, and the internet giant still uses tape for archiving.

## Application backup

SMBs running critical services such as Exchange will want these applications protected as well as their data. This is one area where there are marked differences between backup products: some have few facilities for backing up and restoring Exchange, while others provide top-notch granular



recovery tools, allowing you to restore individual emails. We tested these capabilities in all four of this month's products: some use Kroll Ontrack PowerControls, which works well enough but requires the Exchange EDB file to be restored to a separate location before emails can be extracted.

SQL Server, on the other hand, is less demanding: all of the products we tried support individual database backup and restore. We tested with SQL Server 2014 and had no problems protecting and restoring our databases.

As our Exchange 2013 and SQL Server 2014 apps were Hyper-V VMs

**ABOVE Data deduplication is a standard feature of Arcserve Backup and can make big storage savings**

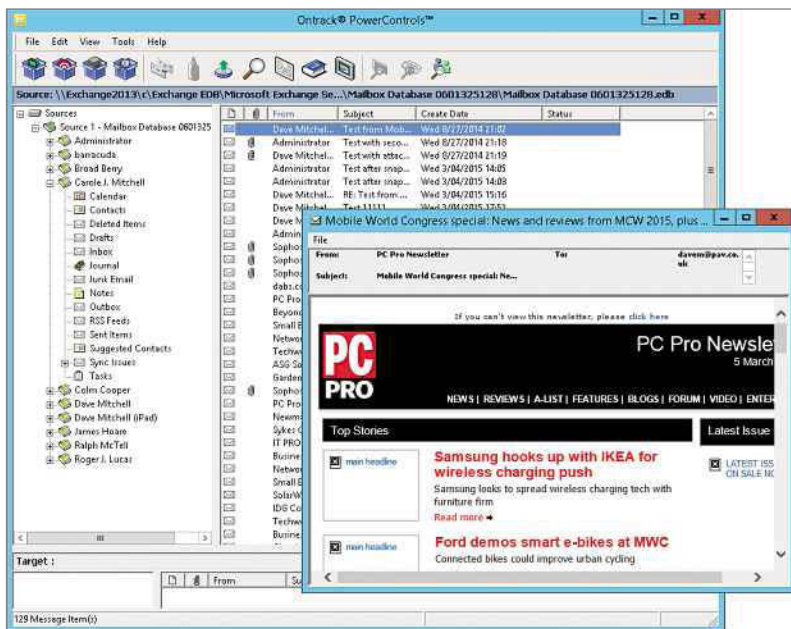
in an Active Directory domain, we were also able to test virtualisation support. Again, this is an area where features vary considerably. The bottom line is that the more you pay, the better the service you get. Some products offer granular file, database and mailbox item recovery from within VM backups.

## Management central

Network admins who want an easy life should look for products that allow backups for the entire business to be managed from one console. Keeping everything under one roof makes it much easier to deploy and monitor backup jobs, manage storage devices, spot problems and run remote restores.

We found that management features vary considerably between products, so we recommend doing a proper evaluation before you invest in a backup package. Most of the good backup products can be downloaded with an evaluation licence that enables everything for a limited time, with some letting you experiment for up to 60 days.

Those businesses that don't have a tested and properly managed data-protection strategy in place are heading straight for trouble. Implementing a good backup regime isn't rocket science, and the four products in this guide are all very easy to install and use. Prices will vary depending on the features on offer, so read on to see which tool suits your budget and, more importantly, your survival plan.



**LEFT NovaStor uses Kroll Ontrack to extract individual emails for Exchange item-level restore**





# Arcserve Backup 16.5

Consistent design, ease of use and plenty of data-protection features make this great value

**SCORE ★★★★★**

**PRICE** One server, from £350 exc VAT from span.com

Arcserve Backup scores highly for consistency – despite its numerous upgrades, its central management console has retained the same form and feel for many years. New users will love its simplicity, and users of older versions won't be faced with a daunting learning curve.

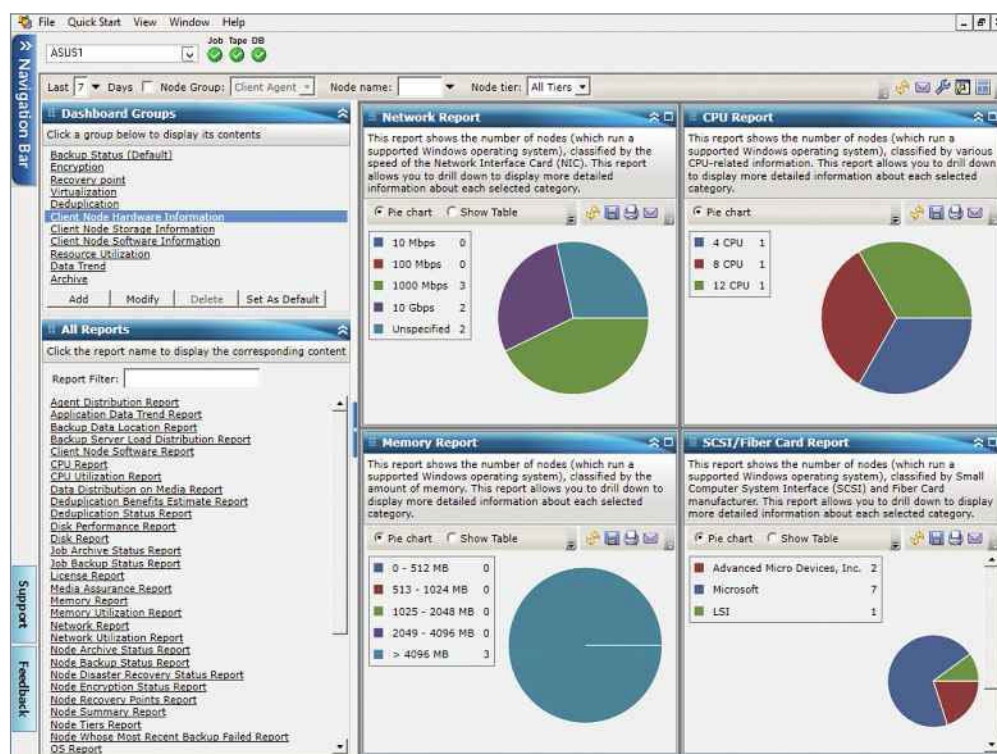
However, plenty has changed underneath: Arcserve Backup has grown into a total backup solution for securing all your servers, applications and virtualised environments. It can archive to the cloud, works hand in glove with Arcserve UDP appliances, and is the only backup package that includes integral data deduplication in the standard price.

All the action takes place within the intuitive Manager console, which makes the backup process simple. Once we'd pushed all the relevant agents to our test systems, they popped up ready for action in the backup source window. We were able to browse machines, select specific folders and files, pick Hyper-V VMs and choose our SQL Server 2014 databases. Our Exchange 2013 server was also listed, with the mailbox databases and mailboxes appearing as separate entities under their own organisational folder in the same tree.

Hyper-V host-level backups simply require the Windows agent to be loaded on the host

system: one agent licence lets you back up any number of guest VMs. For file-level backups and restores, an agent is loaded within each VM, which appear in the source view along with their virtual volumes.

For standard protection strategies, you can pick from full, incremental and differential backups. You can use built-in rotation schemes, apply encryption and decide where to back up the data. Arcserve Backup



works with tape drives, libraries, virtual tape libraries, local disks, NAS shares and IP SANs.

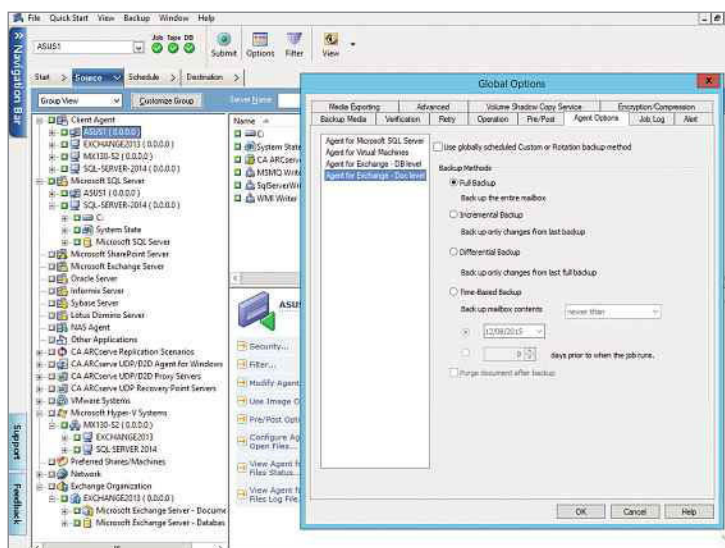
There's cloud storage support too, extending to Amazon Web Services, Microsoft Azure, Eucalyptus and Fujitsu Cloud, but these can only be used as part of a disk-to-disk-to-cloud (D2D2C) staging and data-migration strategy. We had no problems using our Amazon Web Services account and created virtual storage devices that linked up to our cloud buckets.

The deduplication feature is a cinch to use. Once we'd created a new backup device, we could place the data and index files on separate local or remote locations. Arcserve makes no specific claims about its data-reduction ratios, so we turned to the Binary Testing deduplication test suite to find out. Using a 4GB dataset

**ABOVE** The Dashboard provides numerous useful metrics



**BELOW** Why change Arcserve Backup's management console when it's worked so well for years?



of 1,000 files, we introduced controlled changes within a percentage of the files throughout a standard weekly backup strategy. After a one-month simulation, we saw an impressive reduction ratio of over 8:1 – so for typical business backup, you can expect big storage savings.

Data restoration is easy. You simply select backed-up systems from the Manager console, pick files and folders, and click to restore them to the original location or another destination. The same process can be used for other sources such as SQL databases, and we could restore either our entire Exchange 2013 database or individual mailboxes, folders and messages.

You can keep a close eye on the action via the Dashboard, which offers a wealth of information, including status reports on backup jobs, client nodes and encryption, as well as reports on backup data distribution, volume usage, media-assurance operations and backup servers. If you're using deduplication, it also provides reports and graphs on projected storage savings.

Arcserve Backup is one of the longest-serving backup products on the market, and it still sets high standards for data-protection features. Its central console makes management a cinch, while its component- and capacity-based licensing schemes keep it affordable for SMBs.

## REQUIREMENTS

Backup server • Windows Server 2003 upwards



## Iperius Backup Full

Central management features are limited, but a decent choice for small businesses on a budget

SCORE ★★★★★

PRICE One server, £191 exc VAT from [iperiusbackup.co.uk](http://iperiusbackup.co.uk)

One immediate point in Iperius Backup's favour is that the basic version is free. And yet it's not short on features, supporting all Windows desktop and server OSes, with no limits on the number of backup jobs you can run. It also supports a healthy range of destinations including hard disks, RDX drives and NAS shares.

However, if you want to unlock the program's full power, the upgrade costs £191 per system. This is a decent price, adding plenty of extra data-protection features, including support for tape drives, disk imaging for disaster recovery and VSS open file backup. SQL database backup is available too, and cloud-storage options extend to Google Drive, Dropbox, Microsoft OneDrive, Azure and Amazon S3, as well as support for FTP servers and Iperius' own cloud storage. What's more, all paid-for versions, except Desktop, can be remotely managed via the Iperius web console.

Installing the software on a Windows Server 2012 R2 host took less than a minute. No remote-deployment tools are provided, however, so we had to do this by hand on every system we wanted to protect. The web management console, which costs £62 per year, supports up to 50 systems: each one had to be linked to

The screenshot shows the Iperius Backup Web Console interface. At the top, there's a navigation bar with links for 'FREE DOWNLOAD', 'PRODUCTS', 'BUY', and 'CONTACT US'. Below this is a 'Web Console - Computers' section with a search filter and a table of backup jobs. The table has columns for 'Computer name', 'Last backup', 'No. of jobs', 'Notes', 'Result (last 7 days)', 'Update Iperius\*', 'Details', and 'Delete'. Three jobs are listed: 'ASUS1', 'BROAD2400B8', and 'SQL-SERVER-2014'. The 'SQL-SERVER-2014' job shows an 'Errors' result with a link to 'Remove error/warning notifications'.

Computer name	Last backup	No. of jobs	Notes	Result (last 7 days)	Update Iperius*	Details	Delete
ASUS1 Server 2012 R2 Server Std. (evaluation inst.) (64-bit) (8.9600) 192.168.0.65 (31.24.221.144) - Iperius [TRIAL] 4.3.2 Service: Yes - Scheduling: No	18/08/2015 10:09:38 (Today)	2	ASUS1	OK		Details	Delete
BROAD2400B8 Server 2012 R2 Server Std. (full inst.) (64-bit) (8.9600) 192.168.0.50 (31.24.221.144) - Iperius [TRIAL] 4.3.2 Service: Yes - Scheduling: Yes	18/08/2015 14:44:44 (Today)	2	BROAD2400B8	OK		Details	Delete
SQL-SERVER-2014 Server 2012 R2 Server Std. (full inst.) (64-bit) (8.9600) 192.168.0.58 (31.24.221.144) - Iperius [TRIAL] 4.3.2 Service: Yes - Scheduling: Yes	18/08/2015 15:53:21 (Today)	2	SQL-SERVER-2014	Errors <a href="#">Remove error/warning notifications</a>		Details	Delete

\* Commands are processed every 8 minutes

our account with a personal code, but then we could view the status of all backup jobs, run existing jobs, view logs and push client updates to registered systems.

Creating backup jobs also requires a visit to each system, and this can't be done from the web console. Even so, it didn't take long: a wizard guided us through choosing sources, picking a backup strategy and using the powerful scheduler tool. Full backups and regular incrementals are both supported – it was easy to create one job that ran a full backup followed by regular incrementals, and decide on the number of file versions to keep. For backup destinations, we could choose from local volumes and NAS shares mapped to a local drive letter. We also tested using an IP SAN and an FTP server on a Synology storage appliance and had no problems.

You can also choose whether or not to include system files in your backups, and optionally use VSS to

**ABOVE** The web console only provides basic remote job monitoring for registered clients

secure open files. Pre- and post-backup jobs can be configured, and the host can be shut down or rebooted after the backup has finished.

Securing our SQL Server 2014 host wasn't difficult. We used the client to browse for databases, and found we could select all of them or individual ones. Restoring them was just as easy – we browsed the backup location to pick a database, and had the option of restoring it to its original location or elsewhere. If you don't choose the Zip option in a backup job, you can also restore files and folders natively using drag-and-drop. The client provides facilities for viewing the contents of archived backups, tape drives, FTP servers and cloud storage.

**"The limited central management console makes Iperius Backup best suited to SMBs looking to protect a small number of servers"**

One weakness of Iperius Backup is Exchange protection. There are no facilities for data store or mailbox backup, so item-level mailbox restores are off the agenda. All we

could do was secure its database files with a standard backup job. Similarly, while Iperius supports backing up VMs on VMware ESXi hosts, it has no specific abilities for Hyper-V. The free version simply lets you back up your Hyper-V virtual disk files, while the paid-for version adds VSS hot backups of running VMs.

The limited central management console makes Iperius Backup best suited to SMBs looking to protect a small number of servers. The lack of Exchange support might also count against it, but Iperius Backup is easy to use and surprisingly powerful.

### REQUIREMENTS

Windows XP and Server 2003 upwards

The screenshot shows the 'Edit backup job' dialog box in Iperius Backup. It has tabs for 'Items', 'Destinations', 'Options', 'Scheduling', 'E-mail notifications', 'Other processes', and 'Summary'. The 'Options' tab is selected, showing various backup options. Key options include 'Include hidden files', 'Include system files', 'Include open or locked files (Volume Shadow Copy)', 'Create log file', 'Display backup operation in progress', 'Send notifications to Web Console if available', 'Shut down computer at the end of backup', 'Do not show warnings if no file is copied', 'Zip compression' (Higher speed), 'Normal copy' (Always copy and set the date and time of files), and 'Consider files as equal if the difference is <= 2 seconds'.

**LEFT** Iperius Backup is easy to use and offers a good range of backup features, despite its spartan interface

## NovaStor NovaBackup NAS Suite

Deployment is a drag, but NovaBackup NAS Suite isn't short on features and supports up to three servers

**SCORE** ★★★★★

**PRICE** From £1,042 exc VAT  
from novastor.com

NovaBackup NAS Suite's headline price may look steep, but it includes support for three Windows servers and their VMs, as well as a central management console (CMC). It can also handle a wide range of backup destinations, including cloud providers, and supports granular restores of VMware and Hyper-V VMs – plus mailbox item restores for Exchange.

Installation is a two-part process: after we'd loaded the CMC on a Windows 7 system, we had to manually install the standard NovaBackup software on each system to be protected. Each then had to be pointed at the CMS system, by entering its IP address into the client's default settings page. It's not a difficult task, but it's tiresome compared to Arcserve's software, which simply pushes out agents as required.

With this done, our systems popped up in the CMC console, and we could get an overview of our backup status. From the console we could tell which agents were in contact with the CMC, with colour-coded icons for each showing the status of their latest backup job. If you wish, you can grant users individual access to the CMC, and assign them roles to determine whether they have full access, can edit and run backup jobs or just view the job logs.

It's worth stepping back and sorting out groups and associated backup schedules first. A group's backup schedules are applied to an agent when they are added, and we could create scheduled full, incremental, differential or image-based backups. In contrast to products such as Arcserve Backup, the system running the CMC does not provide centralised backup device management. Each system being secured must



have its own access to a backup device. This can be a disk, tape drive, cloud storage or remote NAS share. NAS shares mapped to a local drive letter aren't supported – to use our Synology appliance, we had to set up a network location using its UNC path. But this wasn't hard, and can be done locally at the client interface or from the CMC.

From the CMC, we could create on-demand backup jobs for specific systems, remotely browse their drives, select folders and also add the system state. Image-based backups for disaster recovery can also be run from here. With the plugin installed on our Hyper-V host, we could browse our VMs and add them to a backup job. For granular recovery of our SQL Server 2014 and Exchange 2013 systems, we had to install

**ABOVE** The NovaBackup client must be manually installed and pointed to the system running the web console

**"The deployment process is tedious, but once the NAS Suite is up and running, it offers some quality backup features for the price"**

**BELOW** The web console app allows backup and restore jobs to be managed remotely

the agent locally so that it loaded the relevant plugin.

Exchange item-level recovery requires the single mailbox restore component to be installed on a system that can access the Exchange server. This loads the Kroll Ontrack PowerControls, which also need the

Outlook Anywhere and Autodiscover services enabled on the Exchange server. In practice, we found this approach worked perfectly well, but the granular recovery feature in Veritas

Backup Exec was easier to use.

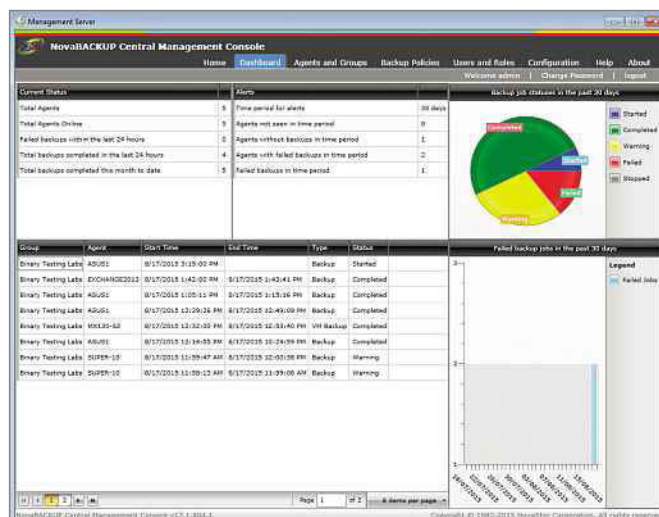
In that package, we could use the central console to restore mailbox items directly from our Hyper-V VM backups.

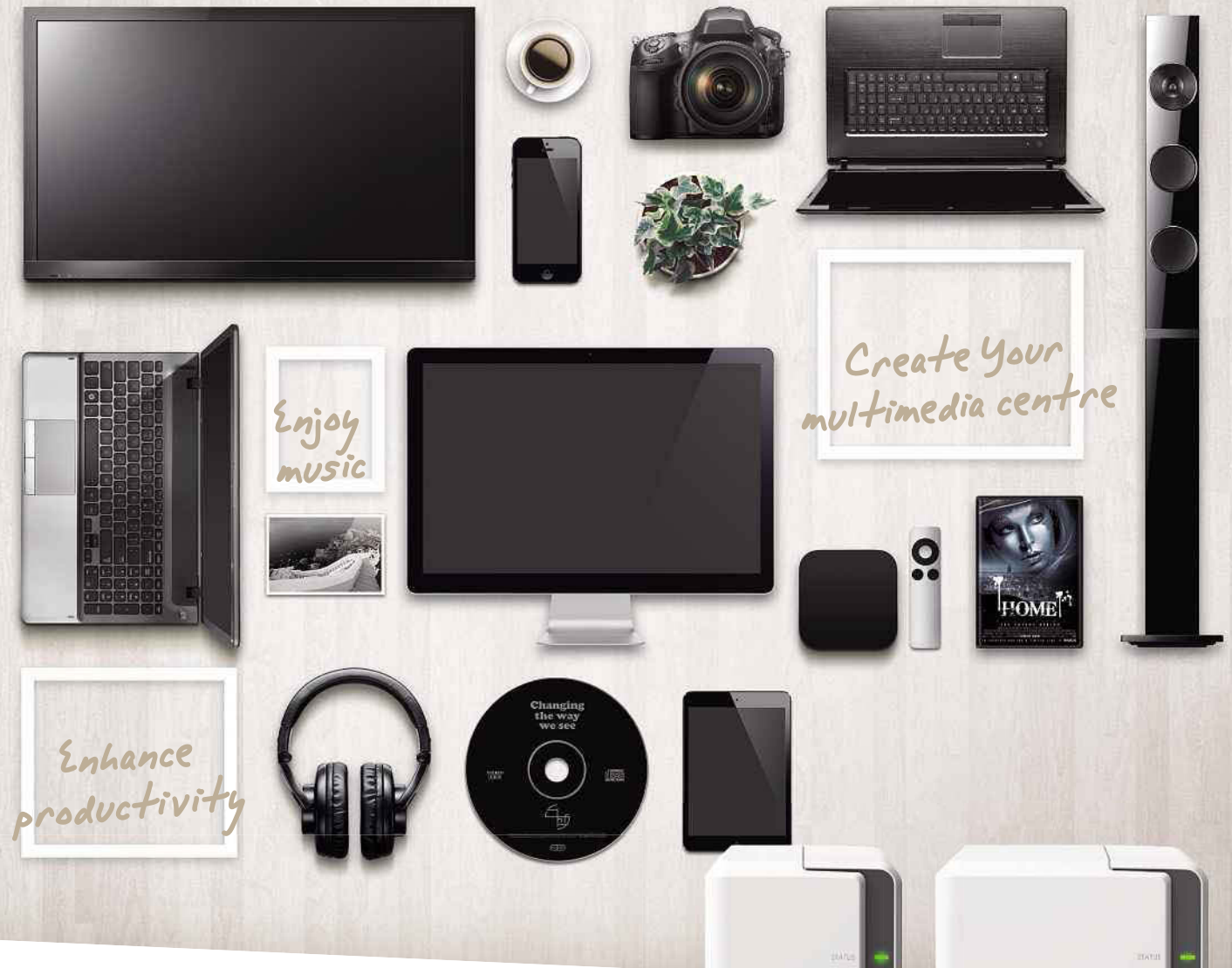
For files and folder recovery, we used the CMC to select a system, browse its backups and restore files to their original location or another destination. Desktop backup isn't included in this edition, but we were able to install the optional NovaBackup Workstation software on our Windows 10 clients and control them from the CMC.

The deployment process is tedious, but once NovaBackup NAS Suite is up and running, it offers high-quality backup and recovery features for the price. The CMC isn't perfect, but it's quite capable of managing all your backup strategies and includes useful granular recovery tools for Exchange.

### REQUIREMENTS

Windows Server 2003 upwards





## DS115j AND DS215j

### THE PERFECT DATA STORAGE SOLUTION FOR YOUR HOME

Run your own personal cloud from the comfort and security of your home



#### POWER-SAVING AND RELIABLE

DS215j features a dual-core CPU, supports up to 12TB of data and consumes less than 14w when active while the DS115j offers a stable storage environment for users with no need for raid, consuming less than 11w when active.

#### ACCESS ANYWHERE, ANYTIME

Synology NAS' and the intuitive DiskStation Manager (DSM) software allow users to sync and share files among multiple devices, including Windows PC, Mac, Linux, iOS, Android and Windows Phone.

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iOS



Synology's Media  
Accolades





## Veritas Backup Exec 15

Easy backup management, excellent VM support and attractive pricing make this a tempting choice for SMBs

SCORE ★★★★★

PRICE 1TB Capacity Edition Lite, £1,096 exc VAT from lambda-tek.com

Backup Exec was acquired by Symantec in 2005, but it's now been sold off – the latest version is back under the old Veritas brand. The new management says it aims to dedicate more development staff to the product, and to deliver major updates more rapidly than Symantec did.

So far there's been no change to the front-end management console, which caused such a furore when it was launched in Backup Exec 2012. It's easy enough to use, but we still advise users planning to upgrade from earlier versions to test it before taking the plunge, because it's radically different. However, the licensing scheme has been streamlined: Veritas recommends its Capacity Edition Lite for SMBs. Starting with 1TB of uncompressed backup capacity, this gives you every feature of the software, save for Mac support, deduplication and multi-drive tape libraries.

Installing Backup Exec 15 (BE15) on a Windows Server 2012 R2 system took us around 30 minutes. We then used the console's wizard to push agents out to our Hyper-V system, hosting Exchange 2013 and SQL Server 2014. Next, we configured our backup storage: for testing, we used multiple IP SAN targets on a Synology storage appliance, connected to the backup server over 10GbE.

BE15 employs a resource-centric model designed to reduce the steps needed to create a complete backup strategy. From the Backup and Restore tab we selected the servers we wanted to protect and chose a strategy from the dropdown list. Choices are based on defined storage



and active licences – it was easy to create a backup-to-disk job, with extra disk or tape staging for all our servers, with just a few clicks. Our new job defaulted to starting with a full backup followed by daily incrementals, but we could modify these to suit and change the backup sources, destinations and schedules, as well as replace incrementals with differentials and add further stages.

Our Hyper-V VMs were handled smoothly. After we'd declared the host to BE15, it went away and loaded the relevant agents onto the host, and onto our Exchange 2013 and SQL Server 2014 VMs. Slightly confusingly, it added separate entries for both VMs in the server list, but when we tried to use them to create a backup job, BE15 told us to select the host instead.

That aside, the Hyper-V host backup worked fine, and during

**ABOVE** You can manage every aspect of backup and recovery from the central console



**“It's good to have the Job Monitor back in its rightful place, which let us keep a close eye on our backup and restore tasks”**

job creation we enabled the granular recovery options for both the Exchange and SQL Server VMs. This adds wizard-driven options to restore files, folders, Exchange mailbox items and selected SQL databases residing in the VMs.

It's good to have the Job Monitor back in its rightful place (it was removed in BE12 but restored in last year's update), which let us keep a close eye on our backup and restore tasks. Two panels show running jobs and job history, and we applied filters to each panel to refine the information displayed. Data restoration is nicely

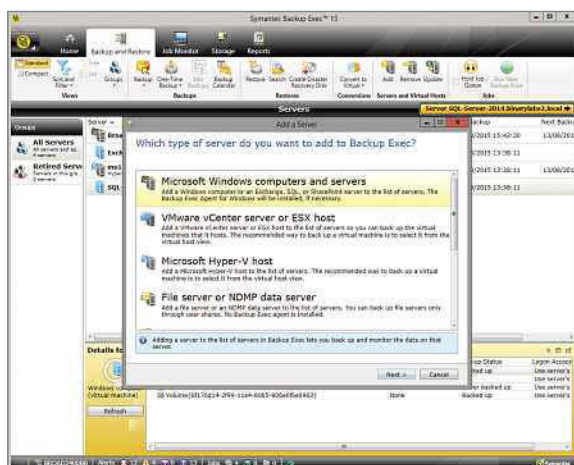
streamlined: when we selected a server, BE15 presented only the relevant options for this system. For our standard Windows servers, we had the option to restore files and folders, while the

Exchange wizard provided extra choices for restoring the entire data store or individual mailbox items.

Veritas has big plans for Backup Exec 15. It aims to provide quarterly updates, and major upgrades within 60 days of new OS releases (this took two years under Symantec). Overall, Backup Exec 15 delivers an impressive range of features and automated backup strategies – and the new Capacity Edition Lite licence is good value. **DAVE MITCHELL**

### REQUIREMENTS

Backup server • Windows Server 2003 R2 upwards



**LEFT** Agents are easily pushed out to remote servers and backup job creation is neatly wizard-driven



# How 3D-printed rats could offer schools a vegetarian dissection

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**EXCLUSIVE**

# Kodak i2620

A fast, affordable and compact scanner with top output quality and a generous software bundle

**SCORE** ★★★★★

**PRICE** £575 exc VAT from [uk.insight.com](http://uk.insight.com)

If you work in a small office with big scanning demands, Kodak's i2620 could be the answer. It's a compact desktop scanner with a top speed of 60ppm, full duplex capabilities and an impressive daily duty cycle of 7,000 pages. When not in use, the main body can be swivelled upright to save space.

The i2620 is very well built, and the reassuringly solid swivel mechanism protects the output tray by tucking it underneath as you bring the body upright. The input tray flips up from the front and has a big appetite, holding up to 100 sheets of 80gsm paper. Three buttons are provided on the front – two for selecting a scan profile and a third for starting scans. The LCD panel helpfully shows what the selected profile does, although the lack of backlight means it isn't as legible as it could be.

Setup wasn't completely hitch-free: when we tried connecting the scanner to a Windows 10 desktop, Kodak's bundled Smart Touch software couldn't identify it. However, it was simply a problem with old drivers, so downloading the latest software from the Kodak site quickly got us up and running.

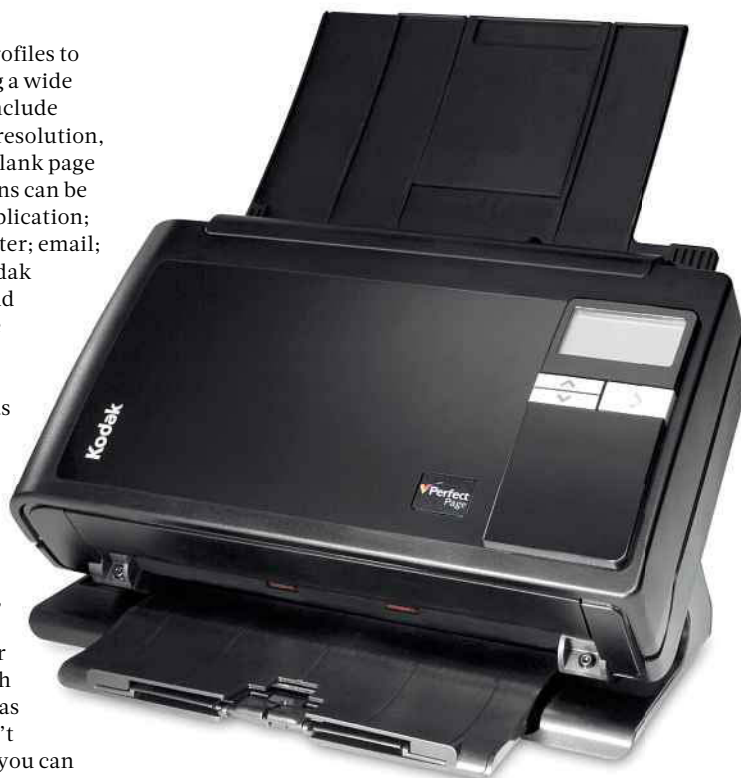
Smart Touch neatly streamlines scanning operations: we were able

to assign nine different profiles to the scanner, each offering a wide range of settings. These include simplex or duplex scans, resolution, anti-skew, hole-fill and blank page skipping. Scan destinations can be a file; searchable PDF; application; local, network or fax printer; email; or SharePoint Online. Kodak has also improved its cloud destinations, with Google Drive support finally included. We had no problems using this: it was quick and easy to register Smart Touch with our Google account and select the cloud folder we wanted scans sent to.

Options are provided for Box and Evernote and, for the latter, we had no difficulty logging in to our account from Smart Touch and scanning documents as notes. Sadly, Dropbox isn't explicitly supported, but you can always scan directly to your local sync folder.

There's a barcode-detection mode too – Smart Touch creates separate files whenever one is scanned. But, for more advanced scan automation and barcode management, you'll need to buy Kodak's Capture Pro software. A limited version is included, which has enhanced batch-scanning functions, but only the full version can use barcodes and other marks, such as ticks, for document processing and sorting. You can't run it alongside Smart Touch either, as it commandeers the scanner with its own settings.

If your needs are more modest, the bundled Nuance PaperPort might be the right choice, providing solid document and image management, while OmniPage delivers accurate OCR. Kodak also includes WIA,



**ABOVE** The i2620 is well built, and has protection for the output tray



**“Scan quality is excellent, so 200dpi should be perfectly adequate for document archiving – text at this resolution was very clear”**

TWAIN and ISIS drivers, and we found its entire software package worked fine with Windows 10.

The 60ppm top speed can be achieved in both mono or colour, but only at 200dpi. Colour scans at 300dpi dropped to 42ppm, and fell to 10ppm at 600dpi. However, scan quality is excellent, so 200dpi should be perfectly adequate for document archiving – text at this resolution was very clear, and searchable PDFs were impressively accurate.

Paper handling was impeccable too, with the i2620 taking wads of statements and receipts in its stride. We also fed in multiple embossed credit and identity cards, which the scanner handled with aplomb, as long as they were placed correctly in

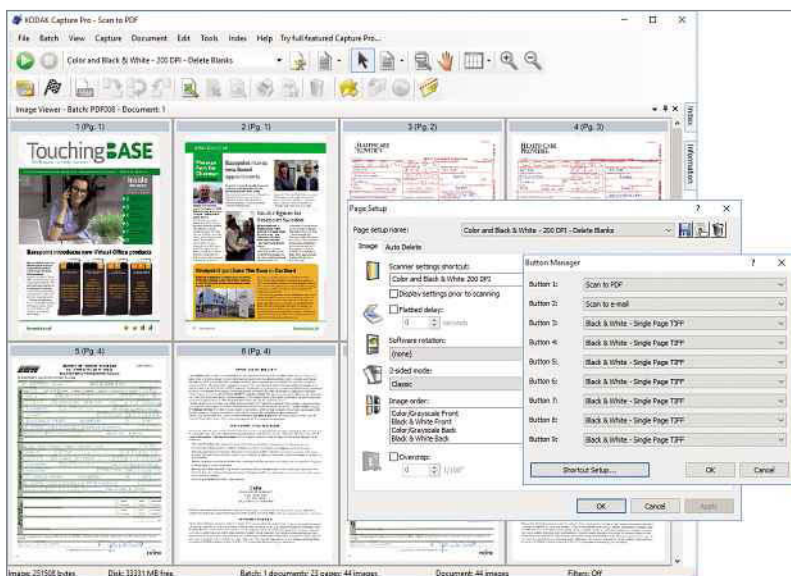
the feeder. For a high-speed scanner, the i2620 is quiet, confirming its suitability for a space-limited office.

Kodak's i2620 combines top scanning speeds and output quality at a competitive price. Its ease of use, good build quality, duplex support and generous software bundle make this our small-business desktop scanner of choice. **DAVE MITCHELL**

## SPECIFICATIONS

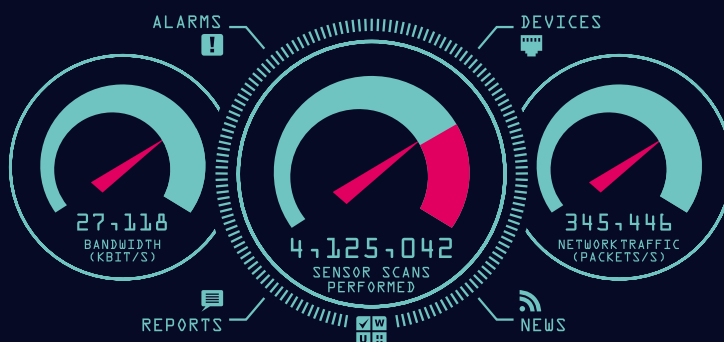
Desktop A4 colour scanner • 600dpi optical resolution • 60ppm @ 200dpi mono/colour • simplex/duplex • 100-page feeder • 7,000 sheets per day • USB 2 • external PSU • TWAIN, ISIS and WIA drivers • Nuance PaperPort 14, OmniPage 18, Kodak Smart Touch and Capture Pro LE software • 5.5kg • 336 x 162 x 246mm (WDH, closed) • 3yr limited warranty

**LEFT** Kodak's Capture Pro software offers a good range of document-management tools





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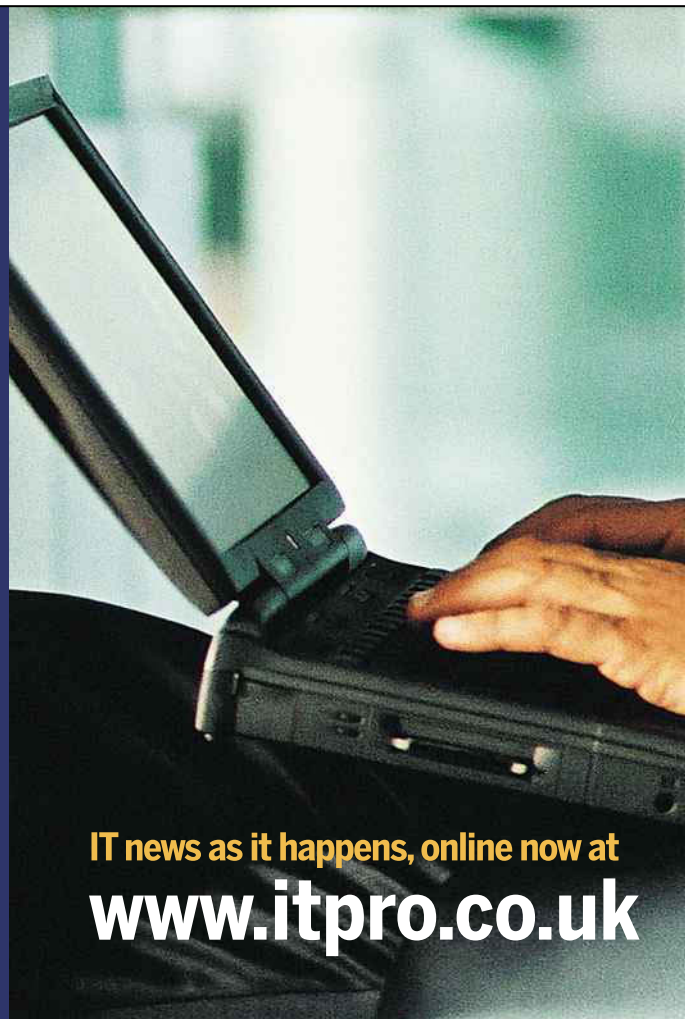
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## Qnap TS-563

Good value, a great feature set and 10GbE readiness make this a solid future-proof NAS

**SCORE** ★★★★★

**PRICE** Diskless, £484 exc VAT from ebuyer.com

Qnap's TS-563 is a NAS that means business: it's powered by a quad-core 2GHz AMD CPU, and its five internal bays can be supplemented with up to 21 drives over USB 3, using Qnap's UX disk enclosures. What's more, even though it comes with four Gigabit Ethernet ports, it can be upgraded to 10GbE via a PCI Express option.

You can buy it with 2GB or 8GB of DDR3L RAM – we reviewed the latter. For ambitious tasks this can be easily expanded to 16GB, since a spare SODIMM slot resides on the outer side of the motherboard.

Qnap's quick-start cloud portal makes installation a breeze: simply enter the model and type in the unique cloud key from the label, then register the appliance with a myQNAPcloud account. This online-friendly approach is also visible in cloud backup: the OpenStack Swift app supports big cloud storage providers such as HP Cloud, IBM SoftLayer and Rackspace.

We had no problem using the S3 Plus app with our Amazon Web Services account, nor with the Glacier app. The new Cloud Drive Sync app

also handles Dropbox and Google Drive. We tested using the former, linking it to our account and setting up a continuous sync schedule across selected local and cloud folders. It's also easy to set up the TS-563 as a private cloud: we linked the Windows desktop app to the appliance and then defined sets of paired folders for real-time file syncing.

When it comes to speed, the TS-563 is a mean performer. We tested with four 4TB WD Red drives, configured in a RAID5 array. Over Gigabit, we were able to drag and drop copies of a 50GB test file at sustained read and write speeds of 113MB/sec and 112MB/sec. Our 22.4GB backup test folder, with its 10,500 small files, was also dealt with efficiently, copying across at an average of 87MB/sec.

For 10GbE testing, we fitted an Emulex dual-port card in the TS-563 using the proprietary bracket, and saw Iometer report raw read and write NAS speeds of 772MB/sec and 441MB/sec. Real-world performance was more modest, with our 50GB file copy completing at read and write speeds of 415MB/sec and 210MB/sec. Our backup test didn't see a huge improvement, with the speed increasing to only 130MB/sec.

We've always liked Qnap's Virtualization Station app, which lets the appliance run a full desktop or server OS inside a VM. We created a



**ABOVE** The TS-563 is a mean performer



**“We’ve always liked Virtualization Station, which lets the appliance run a full desktop or server OS inside a VM”**

**BELOW** The Q’center app has a dashboard for monitoring your NAS collection

medium-sized VM using the wizard and installed Windows Server 2012 R2 from an ISO file on the appliance in less than 15 minutes. With this done, we could access the VM and its Windows OS directly from the app's console or via RDP. However, the TS-563 doesn't have an HDMI port, so you can't use it directly as a PC.

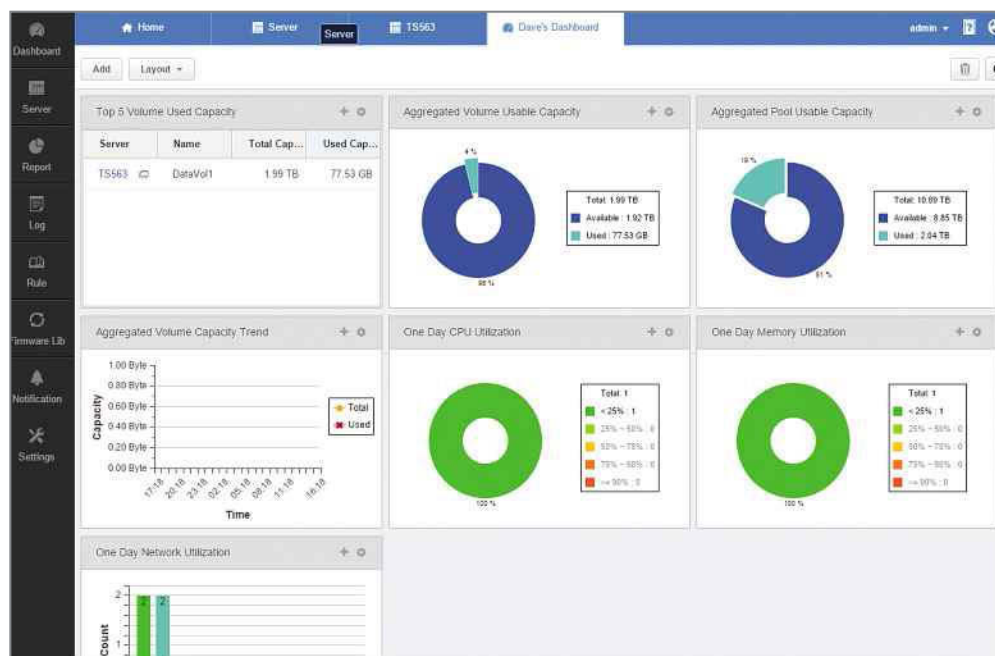
To see what's around the corner, we also updated the TS-563 with the QTS 4.2 beta. This gives the web console a major refresh, with the new file manager providing direct access to the contents of our Dropbox and Google Drive cloud stores.

The new Q'center app promises slick centralised management of all your QNAP boxes – with customisable dashboards – and Qsync performance has also been improved. It's now possible to back up Gmail accounts, Virtualization Station 2 adds a virtual switch, and Qsirch offers text-based searches to quickly locate files on the appliance.

The TS-563 is almost the same price as Synology's similar DS1515+, but has the added bonus of being 10GbE-ready. Even if performance over 10GbE isn't always a huge leap over Gigabit, it's no slouch – and the upcoming QTS 4.2 will deliver a slew of useful features to make the TS-563 even better. **DAVE MITCHELL**

### SPECIFICATIONS

Desktop chassis • quad-core 2GHz AMD G-Series • 8GB DDR3L RAM (max 16GB) • 5 x SATA hot-swap drive bays • supports RAID0, 1, 5, 6, 10, JBOD, hot spare • 4 x Gigabit Ethernet • 5 x USB 3 • PCI-E Gen2 x 4 slot • internal PSU • 211 x 236 x 185mm (WDH) • web browser management • 2yr RTB warranty



# TeraStation™ 3200

## When Versatility wins over Power.



In the land of the Sumo, size and power can sometimes come in smaller packages, as the new TeraStation™ 3200 will prove to you. The affordable NAS solution for small offices and demanding home users features an enterprise-class functional range, normally found in only high-end business storage. Designed in the country steeped in a tradition of martial arts, it offers superior reliability and security, keeping your critical data safe at all times.

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## THE BUSINESS QUESTION

# How do we implement remote working?

Darien Graham-Smith discovers how remote access can free up resources and improve efficiency

There are plenty of reasons to embrace remote working. Allowing employees to work from home, or wherever they happen to be, can free up valuable office resources and boost morale. As your company grows, remote working also lets you find and hire talent without having to restrict your search to the radius of your headquarters. At the same time, managing a remote workforce can present challenges in terms of productivity and security.

### ■ Why are you doing it?

Like any business process, remote working needs to be managed. A policy should be in place that dictates the goals of remote working, plus measures by which you can identify whether something needs to change.

"It could be that you're a small business, and you already have an

office, but you decide 'we want flexibility for our employees,'" noted Chris Martin, CTO of conferencing specialist Powwownow. "That might be parents, who want to take their children to a crèche or to school. Or, it might be about productivity and efficiency – allowing people to focus on projects without distractions.

"Then your organisation needs to put together guidelines on the expectations of people working remotely. For example, that they're going to be able to attend meetings as if they were in the office, and be available for ad hoc communications. Plus, silly things like keeping their diaries up to date so that people can see when they're available."

Equally important is to manage the expectations of those workers who remain in the office. "People in the office mustn't exclude the remote

workers from all that's going on," warned Martin. "Everyone needs to be familiar with the set of tools that remote workers use, so that anyone can collaborate with anyone else, whether in the office or remotely."

### ■ Staying in touch

Choosing that set of tools is important. For some businesses, the humble telephone may be able to do much of the legwork. But this doesn't mean having to rely on the regular phone network. An IP-PBX can help you route and transfer phone calls around a geographically diverse team, and it can be set up and managed in-house.

"A software-based IP-PBX is easily implemented," said Maria Stoitsi, marketing manager at IP telephony provider 3CX. "It can use your existing hardware infrastructure, and if it's Windows-based, the IT staff don't need any special skills to implement and maintain it."

There's another advantage too: "In most cases, maintaining a traditional phone system is far more expensive than investing in a new technology," noted Stoitsi. "The ROI is quickly achieved due to the generated cost reduction."

If you're keen to keep things simple inside the office, you don't even need

to run your own PBX server. "With the popularity of cloud computing, deployment options such as hosted PBX are possible," explained Stoitsi,

**"A policy should dictate the goals of remote working, plus measures by which you can identify whether something needs to change"**

“allowing smaller businesses to implement a modern cloud phone system without the need to invest in expensive hardware.”

## ■ Videoconferencing

For more personal, hands-free communication, many businesses turn to videoconferencing. Once the preserve of the boardroom, such systems can now simply be a part of your suite of collaboration software.

“It’s turned our market on its head,” declared Andy Nolan, sales director at LifeSize – a division of Logitech focusing on flexible videoconferencing tech. “Only a few years ago, you’d have to buy a black box for videoconferencing. Now you can sign up to a subscription for as few as eight users, and you can all be online for a couple of thousand pounds.”

“We’ve managed to achieve that through providing access from the devices people already have – a tablet, smartphone, laptop, or Mac for example. This is a key catalyst for SMEs with restricted budgets.”

That change is supported by the fact that it’s now possible to get online from wherever you are. “Broadband is far more accessible and available than it was,” Nolan said. “We talk about ‘agile working’: it’s not just about working from home. You can be at a partner’s site, or a customer site, or in a meeting, and jump on and connect to the office as and when you need to.”

## ■ Data and applications

Communication is important, but employees also need access to their data and applications. One option is to switch to a cloud-based set of tools – which may be easier than you think. “Most enterprises, when they look into it, are surprised at how many cloud-based applications they’re already using,” noted Tommy Armstrong, CTO of IT-as-a-service consultancy Virtual Clarity. Even for

businesses that currently rely on local applications, “often there are cloud applications available with good enough functionality, and a migration path to make the transition straightforward.”

The challenge is in how to manage an application suite of which you don’t have full control. “It’s important to think about processes,” noted Armstrong. “Which processes can be moved from a legacy application to a cloud-based app? What constraints are there regarding regulatory compliance?”

The cloud isn’t perfect for everyone, however: “With legacy applications, which are critical to the business but that can’t migrate easily to the cloud, solutions such as desktop virtualisation provide a route out of managing on-premise distributed infrastructure,” he said.

In practice, this means a managed remote-access service, which allows workers to use remote apps or even entire desktops with systems such as Citrix GoToMyPC or Workspace Suite. “All our employees use Citrix to connect to our network,” revealed Richard Carty, Director of West Midlands-based Netshield Enterprise Services. “This centralises the solution: you can use any application, including those already published to the Citrix desktop. It’s a software vendor-independent platform.”

Such an approach not only does away with the need to install and maintain local software on remote employees’ PCs, it also helps keep things secure. “Applications and data are stored centrally,” explained Carty, “so the user’s device doesn’t store any data, and two-factor authentication can be deployed if it’s required.”



**ABOVE** With the right tools, employees can be both productive and efficient when working remotely

As Mark Jourdain at Solution Consultants pointed out, there are other measures you might need to take in order to reduce the risks of remote working. “Set up secure passwords, and automatic wipes of computers and devices; ensure you have automatic backups of data stored on devices.”

These security measures, as well as the general demands of keeping a central desktop service, do call for some management. “It’s best to

manage remote working, to keep everything running smoothly,” Carty said. “Also, if a problem does arise then there’s someone on hand to help.”

Despite those costs, remote access can still be

cheaper than having someone based in the office: “For five users, prices start from £30 per month per user, with discounts for multi-year agreements,” said Richard Carty. And after all, it’s not just about saving money. “The technology becomes an enabler that’s invisible to everyone,” promised Chris Martin. “The tools are there to facilitate the team – and to help people work closer and better.” ●

**“We talk about ‘agile working’: it’s not just about working from home. You can connect to the office as and when you need to”**



## The expert view Steve Cassidy

Remote working is a difficult topic to talk about in general terms, because it produces the most divergent experiences found in IT.

Some people use iPads and Dropbox. Others spend vast sums on VPNs, firewalls, and a number of inter-office tunnels, criss-crossing the public internet. Some mix remote working with BYOD, leaving their data (and that of their clients) on whatever device an employee grabs at that moment.

This is where a consultant really starts to earn their keep, by helping you to figure out the appropriate level of technology for your business needs, alongside the disruption it can manage.

Does this sound like overkill? Certainly, the man from Dropbox would argue so. At a recent PC Pro event, I heard it argued that cloud storage was a national utility, like water or electricity, and there was nothing more to say. Then, at another event, I met a man who worked for Jaguar, who revealed that a standard Jaguar computer build includes 95 separate applications in addition to the naked OS!

So his interest, understandably, was in fully featured remote-access VMs, making use of tricks such as just-in-time application installs to boot up a disposable, temporary machine customised according to a centrally managed policy framework.

A smart CIO will try to divide up the heavyweight burden of application access from the universal interest in document access (which can often even be read-only). This is amenable to brute-force decision-making. After all, if you’re Mr Jaguar and you know that your employees need to work on a full-scale remote VM, the PDF-reading may as well happen through the same delivery mechanism – even though it could be done more lightly with an extranet and cloud-replicator service.

A platform that appears to be a sledgehammer to the single-app user may well be a Swiss army knife for another. Working out where your company fits, or ought to fit, on that scale is rarely a quick or simple process.



# The five ways collaboration makes your business smarter

From pooling specialist knowledge to figuring out the most efficient working practices, our experts reveal why collaboration is the route to a better business

In association with



Over the past 50 years, the technology underpinning the way we work has changed enormously – but sometimes our methods of working haven't.

Many companies remain stuck in old ways of thinking and tired workflows. Such companies are living on borrowed time: as a more tech-savvy workforce emerges, they need to change to satisfy their employees' needs, or risk losing them. But through the adoption of collaborative software – and collaborative mindsets – a lumbering tanker of a business can become agile once again.

At this year's inaugural Collaboration & Communication 2015 event, held at the Museum of

London and sponsored by SMART kapp, a panel of industry gurus sat down and hashed out five reasons why collaborative working is key to a successful business.

## 1 It allows you to do more with less

As head of PwC UK's digital customer strategy, Kat Mandelstein is a firm believer in collaborative technology. However, her clients are focusing on one need in particular: the need to do more with less.

"A growing business will always need to improve its internal communication and collaboration technologies," she said, "but as it increases in size, its resources will

dwindle. Implementing proper collaboration software to suit your business takes the load off ever-swelling IT departments or a need for more team spaces."

PwC decided the solution was to build its own collaboration software, One, and its own communications suite, Spark. However, not every company is a multinational corporation in need of something quite so bespoke...

**"Employees not only have more knowledge of the job roles they fill, but they have a wealth of experience in different fields too"**

## 2 It increases employee engagement

Ian McBeth, group IT controller at Furniture Village, sees increased



engagement as the most vital reason to embrace collaboration techniques and software.

Top-down management is a surefire way to create disengaged employees. While McBeth admits it's easy as a manager to slip into the mindset of "I have a vision and I want you to do it this way", it's incredibly detrimental to work that way. Through collaborative techniques – Office 365 being Furniture Village's tool of choice – an engaged team can come up with creative solutions.

As McBeth sees it, employees not only have more knowledge of the job roles they fill, but they have a wealth of experience in different fields too. By engaging with them, you can come up with far better plans than anyone could by sitting at the top and ruling with an iron fist.

### 3 It helps you realise the power of company knowledge

They say knowledge is power, and in the world of business the more knowledge you have, the more valuable you are to your shareholders and customers. The "Big Data" boom of the past few years has shown

companies want to know everything about their customers.

As PwC's Mandelstein pointed out, though, unless you can apply that data and prove its benefit, it's totally worthless. Thankfully, collaboration technology is the tool by which you achieve that. By pooling together your company's collective knowledge – say, to provide feedback on a beta interface – and using tools to make sense of the data, you can take that knowledge and turn it into information you can take action on.

### 4 It helps shape best working practices

For Lisandro Nunez, SMART Technologies' collaboration consultant, knowledge-sharing gives you better visibility into what works in your company.

"By introducing collaborative technology, you can see how your employees adopt new ideas and understand the tools they decide to use," he said. "It's about discovering what works best for your company as a whole, gaining feedback on it and then helping maximise it for the different working methods each individual or team has."

Approaching collaboration in this way means your company can operate more effectively in each department.

### 5 It appeals to the young

One theme of the day was that the workplace is filling not only with millennials, but a group of young people who won't stay unless they're happy with the tools provided. Email isn't enough any more: they expect

to communicate at work much more naturally, just as they do with their friends.

Fail to adapt to this change and you'll quickly be left behind. If your business isn't open

to collaborative software or varied communication techniques that suit your employees, you might find it hard to find talented employees to fill the gaps in your workforce.

Taking the plunge to collaborative technology now means you won't have to force your company into it later, when it's older and even more hesitant to change. Simply put, if your business doesn't adopt these practices now, you may not be around to adopt them later. ●

**"Taking the plunge to collaborative technology now means you won't have to force your company into it later"**

## How are we doing? Jeff Lowe, vice president of SMART Technologies

According to a number of studies – including a recent report from IBM – collaboration is the number-one skill required in business. So companies should be asking: how are we doing? What are we learning? And who can we learn from?

SMART Technologies carried out a global study of around 2,500 companies, half of them in North America and around a third in the UK. Our key finding was that collaboration is a maturity model, with five different stages. It starts with a stage we called "unsupported", which basically means there is no strategy for collaboration: anything that's happening, in terms of process or structure, is a one-off. Forty per cent of the market is still in this unstructured, immature phase.

Then we go up into phases called "not integrated" and "integrated". In the integrated phase, companies have tied together their messaging, voice and video systems so that people are all communicating on the same technical platforms. That accounts for only 15%.

The last two stages are "collaborative" and a final one called "optimised". Only 10% of the market is in this top echelon of the model. But when you compare these top tiers to



the bottom rung, you see that these companies are making decisions and innovating at two or three times the pace of companies in other phases.

That's really interesting, because our hypothesis going into this research was that the main benefit would be cost savings from reduced travel. Actually, companies in the higher phases do spend about a third less on travel, versus companies at lower maturity levels. But the real benefit is faster and more informed decision-making. The top 10% are getting incredible value back from their investment in collaboration.

So the question for most companies is: how do we get these business outcomes? There's no one-size-fits-all approach, but our research points to five practices that the best companies follow when it comes to collaboration.

First of all, they have a strategy. Everybody has a sales strategy, or a marketing strategy, but 75% of companies out there do not have a collaboration strategy. You should have a documented strategy, setting out what you're trying to accomplish and how you're going to do it. And the strategy should have an owner, an executive champion.

Number two is making remote participants feel local. People want to feel that they can contribute and share content – they don't want to be passive listeners, but active participants in meetings.

Then there's the importance of "walk up and use" collaboration technologies. Our research showed that the average setup time for a meeting is 12 minutes – that's time spent just trying to get all the technology to work so you can connect with London, or so everyone can see a video. People don't want that. They expect to walk in and start collaborating.

Then there's recognising the importance of real estate and facilities. Collaboration isn't just about what happens in the meeting, but also about the conversations in the hallway, in the canteen, in the huddle room. Leading companies recognise that these informal spaces are as important as, or even more important than, the formal meeting rooms and boardrooms.

Finally, you need a collaboration setup that's easy to manage. You don't want an army of people standing by in case something breaks down when you're having a meeting.

Here at SMART Technologies, those five practices are what we base our products on – such as the SMART kapp, ([smartkapp.com](http://smartkapp.com)), which is a new whiteboard that pairs with your phone. It's all about simple, natural collaboration. That's the reason we invested so much in this global study: so we can understand what our customers want, and create the kind of products businesses need to move up to more advanced levels of collaboration.

And the study isn't over: any business can take the assessment at [smarttech.com/inspiredcollaboration](http://smarttech.com/inspiredcollaboration) and receive a customised report to help it grow.

# Data sovereignty

If your business handles data, you need to be aware of the legal issues regarding where it's stored, says **Davey Winder**



## ■ Data sovereignty? What's that about when it's, erm, abroad?

Data sovereignty is the principle that digital information is subject to the laws of the country in which it's stored. However, the issues involved are far from simple.

## ■ What do I need to know?

Any UK business holding data about third parties is legally obliged to look after it, according to the Data Protection Act 1998, even if that data is stored outside of the UK. The physical location of the data is critical in determining who actually has legal control of it – and who has the right to access it.

## ■ Why do we need to start worrying now?

Cloud services have made data sovereignty an issue for everyone. If you're just sending a file from one desktop to another via the internet, you won't need to worry unduly about it being intercepted. It's quite another situation if you want to store the file, long-term, on a server located in a country where it can be seized by law-enforcement agencies, without your consent or knowledge.

## ■ How can we tell where our data will or won't be stored?

**Cloud services don't tell us the location of their physical servers.**

That's changing. Major players in the cloud space are building new data centres across the EU and assuring customers that data can be geofenced to keep it within legal boundaries. However, in light of the Edward Snowden revelations, not everyone feels confident that multinational cloud providers will keep their data safe. In the USA, the Patriot Act means that, if the intelligence agencies demand that your cloud provider hands over data, the provider might be bound comply even if the data centre is in Europe.

## ■ Surely if we're not doing anything wrong we have nothing to fear?

You may have done nothing wrong under UK law, but what if the country where your data is stored decides you've stepped over a legal or political line? What if the country decides to subpoena your

customer data? You may want to read the Data Protection Act to familiarise yourself with the fines that can be imposed upon your business for disclosing customer data. The scenario may sound outlandish, but here's the thing: the rules regarding data privacy change from country to country, and ignorance is no defence. If your business operates in multiple countries, it's subject to multiple jurisdictions, and you need to know all of their rules. Just to complicate matters, you also need to know about the rules that apply to the places where your data is at any given time.

## ■ So the easiest and safest solution is to store my data with a UK-based cloud outfit?

That would be safest, but, even if the company you have a contract with is based in the UK, it doesn't guarantee that your data will be stored here. If the company is reselling cloud services for one of the big multinationals, for example, your data might actually be shipped off to the US for storage. If your primary data is stored in the UK, you should enquire as to the location of any cloud-provider backup stores.

## ■ What if my cloud provider encrypts the data at rest? Does that make the sovereignty issue go away?

**"If your business operates in multiple countries, it's subject to multiple jurisdictions, and you need to know all of their rules"**

Encrypting data at rest in the cloud is always a good idea, as it can greatly reduce the risk of it being stolen. However, if encryption is handled by the service provider, then that provider will also have the capability to decrypt it, and could be ordered to do so. It's much safer to encrypt

the data at your own gateway, before the data hits the cloud. An alternative approach is tokenisation (see *The jargon*, below): this doesn't prevent foreign law enforcement from demanding access to data, but it does mean they can't read it without talking to you first.

## ■ So, to be clear, whose laws do I need to be worrying about? The country where I'm based, where the cloud provider is based or where the data is stored?

Unfortunately, it seems that the various legislatures around the world have yet to agree an answer to that one. This leaves things open to interpretation, which is a dangerously unpredictable state to be in. The best solution is to go back to the gateway again, and ensure that the data can only be accessed by users within a specified jurisdiction – and only with your express permission. ●

## The jargon

**Data at rest** Information that's sitting on a server, rather than moving from one place to another over the internet.

**Gateway service** Where a process such as tokenisation is applied to data before it's sent out into the cloud.

**Geofencing** Ensuring that data is only stored within a single, specified region – with the option to restrict access.

**Tokenisation** Replacing clear text data with surrogate tokens, so that sensitive information isn't transmitted over the internet.

# Ensure Secure Sharing & Protect your Revenue Streams

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NetMasterClass develops on-line training courses which cost thousands to produce. Two days after one course was released they found it offered for sale on e-bay. That blew away the costs of development and sales going forwards in one single hit. They had to take positive steps to protect their IPR in order to stay in business.

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**Locklizard**





JON HONEYBALL

## “We can reduce our online footprint, but deleting old tweets and pictures from Facebook won’t scare off a spook”

**The bottom line is that I trust Microsoft sufficiently to not be concerned about what’s it’s doing with Windows 10, and you shouldn’t be either**

So Windows 10 has been out in the wild for a while now, and we’ve already been flooded with updates and fixes. It’s clear that a lot of things have needed attention and tweaks, together with the inevitable adjustments. And now the merry-go-round has started up again, with fast-track “Insider” builds starting to roll out for those who want to live at the bleeding edge of the build cycle. So, how well did Windows 10 land? I think that it’s in pretty good shape, barring a few fit-and-finish issues.

Upgrading people’s machines has proven a bit of a bumpy ride, and I’ve had to take several machines back onto Windows 7. It appears that the 8.1 to 10 upgrade might have gone more smoothly, and perhaps there’s a logical reason for that, given that 8.1 is “closer” to 10 than 7 (I’m not getting into numerology, but talking about their underlying codebases). I’ve had some problems with devices that dock and undock a tablet component from their keyboards, but that’s exactly the sort of device-specific problem that is inevitable for a new OS build, and one that will be ironed out in time. I’ve also seen some very strange issues related to screen resolution when running various hypervisors, (especially if you exacerbate the problem by running on a high-DPI screen at the same time). However, a new version of Fusion appears to have fixed much of this.

Is there any reason not to upgrade? Well, let’s talk about those privacy issues. There’s been something of a storm over reporting this matter, with claims that Microsoft continues to snoop after you’ve told Cortana to go boil its head, that your information still ends up in its data centres, and that you have no control over any of this. My answer to these allegations is

simple – get over it! While I absolutely do not subscribe to Google’s view that privacy is now *passé*, if you’re going to use any platform with services tied to cloud engines – whether that be for voice recognition, web searching, data storage, or processing and storing of your photos – then there has to be some privacy trade-off. You cannot keep everything local and still have it processed remotely, and you cannot share stuff between your various devices without creating a pathway between them. Therefore, the real issue is whether or not Microsoft is trustworthy: answer that and everything else will fall into place.

I would like to say that Microsoft can be trusted and that it’s not an issue, but it’s not quite that simple.

Long-term readers may remember my evisceration of Microsoft and its lawyers over the Patriot Act issues that affected its cloud servers – the way it could move your data between territories at the command of the US government. I could point out that there’s still an ongoing court case covering this issue between the US



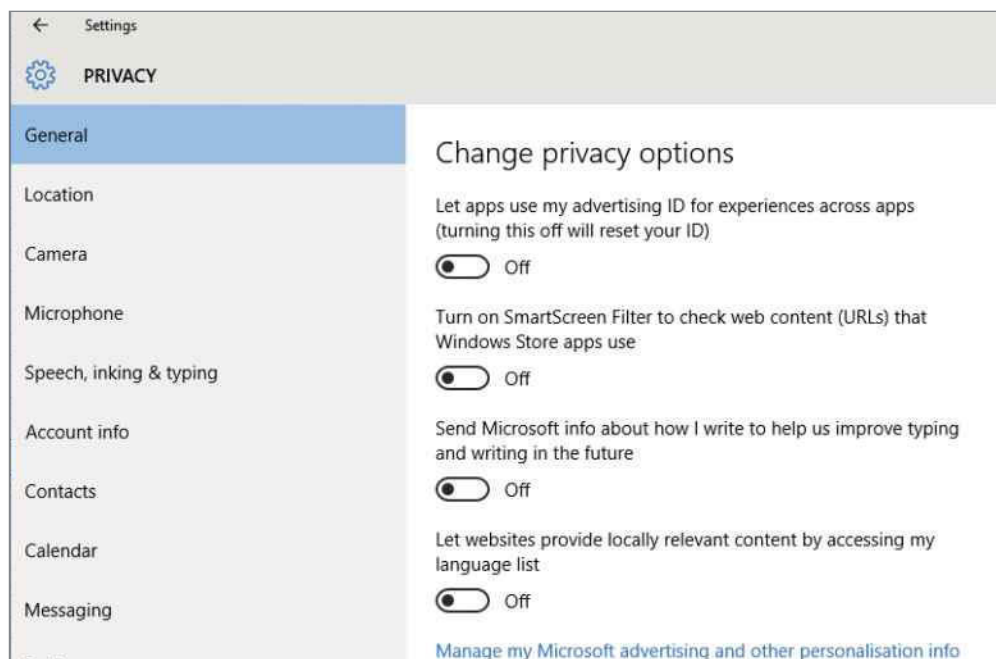
Jon is the MD of an IT consultancy that specialises in testing and deploying hardware  
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**“It’s clear that Microsoft is making loud and sincere calls about cloud privacy today”**

**BELOW Windows 10 offers privacy options to protect your data**

government and Microsoft. I could go even further and say that, back then, Microsoft’s lawyers were plain naive in promising that everything would be fine. And I could go even further than that, but I’d be taken to Guantanamo Bay and never heard of again.

No matter, because it’s clear today that Microsoft is making loud and sincere noises about cloud privacy, as indeed it should. But don’t be fooled into thinking this change of heart came about after it woke up one morning and decided that data privacy is suddenly a big moral issue. The reality is that Microsoft woke up and decided that it’s a big business issue, since a public panic over privacy is likely to throw a spanner into its business plans for global data-centre domination. Even so, the reality remains that, if you want to live in a connected space, you need cloud services, and these need to be hosted somewhere by someone. You can do this yourself, if you really want, but the hardware cost and software complications will be significant. The bottom line is that





**Jon Honeyball**  
Opinion on Windows, Apple and everything in between – [p110](#)



**Paul Ockenden**  
Unique insight into mobile and wireless tech – [p113](#)



**Professor Alan Winfield**  
Can we really build ethical robots? – [p116](#)



**Davey Winder**  
Keeping small businesses safe since 1997 – [p118](#)



**Steve Cassidy**  
The wider vision on cloud and infrastructure – [p120](#)

I trust Microsoft sufficiently to not be concerned about what it's doing with Windows 10, and I don't think you should be either.

If you think this is simply not good enough, that's your prerogative, but please don't stay on an old version of XP that's corroding away day by day. At least move up to a modern open-source operating system such as Linux Mint, and do the job properly. It really is your choice. What's more, given the personal data that people will happily hand over to leaky websites such as a certain secretive dating site, knowing how much toilet roll I buy from Tesco or where my friends are meeting for a pint is hardly going to interest either the Microsoft or NSA spooks. This is not, in any way, me being complacent, and I stress that real secrets must be handled appropriately – but the detritus of everyday life isn't something that particularly bothers me. If it does you, do something proactive about it. We can massively reduce our online digital footprint if we wish to do so, but deleting old tweets and pictures from Facebook won't scare off any serious spook in any country.

## Linn room correction

Sometimes you come across a new technology that really makes you go "oooooh!", and I've recently found one from Linn Products in Glasgow. Famed for its high-end hi-fi equipment, this is a company I've been following and supporting for decades. Those with very long memories might recall articles by our very own Dick Pountain (in the now-defunct *Byte* magazine) that covered Linn's object-based operating system, which ran the robots in its then-futuristic factory – 30 years ago. This, therefore, is not a company that's scared to push the boundaries of technology.

The problems in reproducing high-quality music in small rooms all stem from the fact that we still don't really have a clue how human hearing works. At the end of the day, the human ear is a deeply non-linear transducer that is connected to a soft, grey supercomputer with powers we can only begin to imagine. Technical test equipment – even the very best – simply isn't good enough to scratch the surface of the way a human being



hears and responds to music. Had I thought 30 years ago, when I started in the field of audio analysis, that this would remain the case today, I'd probably have been very upset that so little real progress would be made during my lifetime. Nevertheless, there are some areas where significant steps have been made, and Linn has made one with its new DSP code.

Called Space Optimisation, this system lets you define the shape and size of your listening room: where the walls are, what material they're made of, and the location of the windows and doors. You then work out the ideal position for the speakers using some clever algorithms – but that's only the start. You tell the software where the speakers actually need to be placed (to pacify other members of the household, like the all-important wife/husband/children, and so forth). The system calculates the transforms that need to be applied to the sound stream to permit you to place the speakers in these highly non-ideal positions, yet still hear a high-quality result wherever you sit down.

To achieve this, it calculates the synthetic performance of the room: where its low-frequency resonance

**ABOVE** I tried the Linn Sneaky DSM player in several challenging rooms – and it was up to the task

**"This is very impressive DSP coding, clearly a real-world solution to a real-world problem"**

modes are, where the speakers are placed and what is going to happen in that real room. There's a large database of speaker models that Linn has tested, so it knows the performance of this important transducer. This data gets munged and then sent to the DSPs inside the Linn streaming box, and the calculated room correction is applied to the sound you hear. Does it work? Oh yes, and how. This is seriously impressive DSP coding, clearly a real-world solution to the real-world problem of where to place speakers in a real lounge – not in the perfect positions that hi-fi buffs espouse, but where they can actually fit.

I was so impressed by a demonstration from Linn's engineer Philip Budd, the brains behind this system, given at a recent open day by their leading dealer Cymbiosis in Leicester, that I was tempted to cough up the money for my own Linn Sneaky DSM player. I have tried it in several acoustically challenging rooms, with great success. The control software, which is a free download for Windows and OS X, is easy to use and identifies things such as room resonance modes quite accurately, giving you the tools to fine-tune these to get the best benefit with the minimum overall interference. Processing out the DSP code and then downloading it to the DSP takes but a few seconds.

I think it's great that innovative work is being done in this field, as getting the best sound quality in a domestic environment isn't easy. I'm



lucky enough to have a full set of professional recording equipment, and to have access to venues such as Abbey Road and St John's Smith Square in London. But the problem with audio is that few people actually know what it should sound like – it's ephemeral and not easy to quantify or qualify, even for professionals. Heck, even the task of putting together a taxonomy, let alone a dictionary, of agreed terms is hard enough. Doing room modelling for DSP correction isn't new, but Linn is pushing the boundaries of what can be delivered to real users in their homes, and its efforts should be hugely applauded.

## VMware

The latest version of VMware Fusion has arrived. I can't really find much to say about each new iteration of this tool, simply because it does what it does. Support for Windows 10 has been added, along with OS X 10.11 (at least for the current beta). It does much the same as last year's version, but I get the feeling that this software is effectively turning into an annual subscription. And it's not cheap either: upgrading three licences to Fusion 8 Pro cost me €268 (around £197), which is a tidy sum, and I seem to recall paying nearly that for the last version not so long ago.

I can't argue with the value proposition, though – Fusion is a key part of the way I work, on both my desktop and laptop OS X computers. It's my preferred way of running Windows, especially in an experimental environment, when looking at oddball and weird apps and services. Being able to shut things down, roll back five minutes and restart, all within a few seconds, is an absolutely irreplaceable capability. But Fusion isn't the only game in town in this arena, and it's hard to see much price competition going on between the various vendors. A more friendly upgrade price wouldn't go amiss as a first step.

## Retrospect

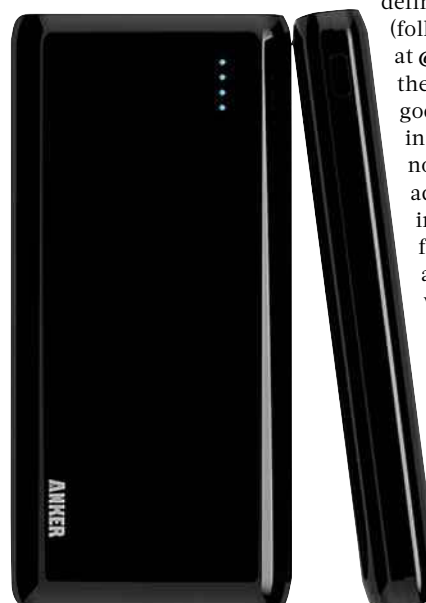
Retrospect backup software continues to impress on the Mac. I use it to back up and archive onto removable drives, and also to the HP LTO-6 robotic library store that we use every day. It's mostly fit-and-forget, and I should probably move it over to a spare box. In the meantime, I can't think of much wrong with it: it's stable, has good reporting, and works well.

## Anker battery pack

The "Useful Toy of the Month" award goes to Anker for its monumentally huge Astro E7 USB charging pack, which comes with an eye-watering 25,600mAh battery. It's not a small unit, nor is it particularly

**ABOVE** VMware Fusion is my preferred way of running Windows, especially in an experimental environment

**BELOW** The Anker Astro E7 comes with an eye-watering 25,600mAh battery



light, but it sports three full-power USB sockets and holds more than enough juice to handle nightly recharges on my iPhone 6s and Apple Watch, night after night. I reckon I can get a good working week from this lump, making it something of a game-changer, especially if you're in one of those hotel rooms with power sockets miles away from the bed. It's now a standard item for my backpack that goes with me on every trip. The only downside is its charging time, which can take most of a working day, but you can plan this to take place at the office so that it doesn't get in the way.

## Dropbox admin mode for no delete

Here's a nice new feature in Dropbox – a platform that continues to impress. You can now set it so that only administrators can make hard deletions from the online store, while attempts by ordinary users are ignored. I like this because it brings an extra layer of protection against mistaken deletes, malware and even disgruntled employees. Consider enabling this by default if you run a business account on Dropbox.

## Mr Snover and Mr Lovell

It's not often that I call someone out by name, but Jeffrey Snover most definitely deserves it (follow him on Twitter at @jsnover). Why the praise? He's the godfather of PowerShell in Windows, which is now the only important administrative interface to Windows for larger organisations and the enterprise world. The GUI has gone, to be replaced by scripts and code. Of course, the GUI is still there really, but it's now a generator of code and consumer of code output. This is all down to Jeffrey and his team, who had the vision to



realise that a graphic user interface could only scale so far and would ultimately be the undoing of the larger-scale server platforms.

Why so? It's because a GUI can't give you all the flexibility that you need. Things change fast, and it's much better to address them through a scalable API than through a GUI that you might have to re-cook every time, to say nothing of the precarious unsuitability of drag-and-drop for handling large amounts of data. In PowerShell, Microsoft has introduced a method by which data centres and server farms can be created, managed and modified in a simple and consistent way, without concern for the size of the system. In September, Jeffrey tweeted: "Bad news: I'll never get another promotion. Good news: I've been promoted to technical fellow (there's nothing above that)." In effect, he's reached the top of the tree within Microsoft for a technical god like him, and it's highly deserved. Well done.

Also a shout-out to my good friend Martyn Lovell from the developer group, who's just reached the giddy heights of "Partner" at Microsoft. This is a very high-level position within the development tools group. I've known Martyn, an expat Englishman, for many years, and his knowledge of the development tools process is exceptional. I strongly suggest you attend one of his technical talks, if you get the opportunity.

## Apple iPad Pro

I'll confess that I'm excited by the forthcoming iPad Pro. I've had large touchscreen devices before – including my 18in Dell which I jokingly call "The Teatray" – but these have suffered both from lack of screen resolution and way too much weight. The iPad Pro might well be a happy compromise between a very high-resolution screen, useful size, low weight and long battery life.

I can't wait to use it in various, admittedly niche, areas such as a touch surface for digital audio workstation editing. You might argue that iPad Pro is overkill for mainstream tablet applications, but its combination of pen and keyboard – both shamelessly pinched from Microsoft's Surface – could make it a killer portable workstation. Let's see what software comes along that's optimised for this new form factor (Microsoft staked an early claim in this area during the keynote).

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## PAUL OCKENDEN

# "Be warned that scammers now apply the term 'smart repeater' to their totally illegal kit"

**Like many of the devices in the IT world, data blackspot solutions have become smaller, faster and cheaper**

I've just received an email from that great contributor to HM Treasury, Amazon, promoting its current "Deal of the Day", which is a SanDisk microSD card. It's not just any microSD card, though, because this one holds 200GB. I'll say that again: 200GB of storage space in a microSD card – one of those ultra-tiny ones, smaller than my little fingernail, and costing a shade over £100 (until midnight tonight, anyway). I find it utterly mind-boggling that we've got to the point where we can pack so much data into such a tiny package.

I realise that this will make me sound old, but the first hard drive I ever bought was a 5MB device made by CDC, which was a full-height model with a diameter of 5.25in. For those of you who have never seen a full-height drive, they were around 83mm high, weighed a tonne (not literally), were particularly fragile, power hungry and, by today's standards, terribly slow. I did some "back of a fag packet" (or "sheet in Excel") calculations and worked out that the ancient drive had a storage density of around 2KB/cm<sup>3</sup>. The SanDisk card offers storage at a density of 1.2TB/cm<sup>3</sup>, which is around six-hundred million times more dense than my old drive.

These are the kind of numbers we take for granted in the IT world, but sometimes I'll still see something that makes my mind boggle, and the email from everyone's favourite taxpayer was just such a moment. So much storage in such a small package (and for so relatively little money) is simply incredible. In fact, it's given me the theme for this column: faster, smaller and cheaper.

## Mobile not-spots revisited

A topic that's always proved popular in this column has been help for places where the mobile signal is either weak or non-existent. In the latter case, you need either a femtocell or some kind of Wi-Fi-calling software on your handset, both of which obviously



Paul owns an agency that helps businesses exploit the web, from sales to marketing and everything in between

[@PaulOckenden](#)

**"Trying to get these devices from your network is like getting blood from a stone"**

require a reasonably good internet connection. However, in places where there's a sniff of signal (and no broadband), another alternative is a mobile signal booster.

It's at this point I need to reiterate what I've previously said, namely that the vast majority of boosters on sale are illegal to use in the UK. Those websites (many of which pretend to be in the UK) will tell you that their devices are legal, or that Ofcom regulations mean approval isn't needed, but that's utter rubbish. Here are a couple of quotes from the Ofcom website: "The unlicensed use of mobile repeaters could result in a fine of up to £5,000 and up to a year in prison" and "a number of websites still try to pass these devices off as a legitimate solution to signal problems. Some even claim these devices – which are also described as mobile phone signal boosters or enhancers – are exempt from Ofcom's regulations. Don't be fooled. They are not."

The one exception that Ofcom makes is for so-called "smart repeaters", which, unlike simple boosters, only operate on a specified mobile network's own frequencies. More importantly, if they're found to be causing interference then the network has the ability to remotely disable them. Be warned that scammers have cottoned on, and now apply the term "smart repeater" to their not-so-smart and totally illegal kit. A good way to spot these is that they may claim their device works on O2 and Vodafone, while a properly licensed smart repeater can only ever work on its own network.

Ofcom's website will steer you toward seeking redress from your mobile network, by requesting that it sends you a signal booster, but trying to get these devices from your network is like getting blood from a stone. Some networks will even tell you that they don't exist. If this happens, your only option is to buy a smart repeater from a third-party supplier – and, seemingly, the only

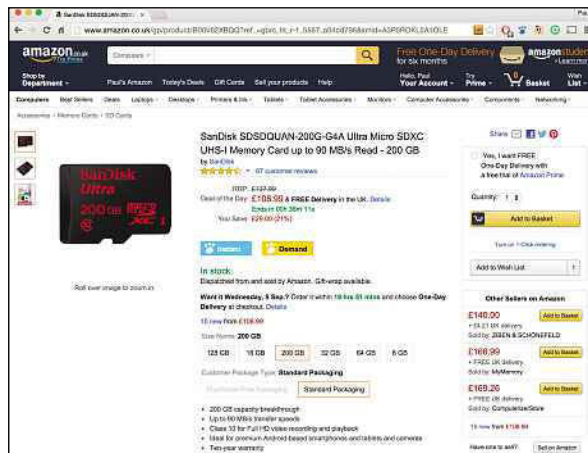
third-party device that's legal to use in the UK right now is the Cel-Fi from Nextivity.

Although this seems to go against the advice on the Ofcom website, I confirmed that it's perfectly legal. An Ofcom spokesperson told me: "Ofcom has not 'approved' the Nextivity Cel-Fi device, but this is an example of a smart repeater. Smart repeaters are controlled by the mobile network via its transmission spectrum without a fixed physical connection. Some mobile network operators are beginning to offer services using these devices that offer improved in-building coverage and data rates. The use of a smart repeater may be authorised under the licence of an operator when connecting to their network. The device would not necessarily have to be supplied by the network, but its use would have to be with their agreement. It would be helpful for the supplier's website and point of sale advice to be clear on this."

Nextivity's UK agent is a company called Frequency Telecom, which works in partnership with all of the main mobile networks to provide such agreement, and the ability to switch off the device as mentioned in the Ofcom statement.

So how does all of this fit in with my "smaller, faster and cheaper" theme? Well, readers with long memories will remember that I originally tested the Cel-Fi RS1, which was great, and then the RS2, which was even better and provided a higher throughput. Both devices worked with 3G-capable phones. I've been testing the latest model in this line, the Cel-Fi Pro, for the past few months and it's a massive improvement over the earlier devices. Its headline feature is that it supports 4G – so if you're one of those unfortunates who normally settles for 3G or 2G, but can just about see 4G by standing on one leg near an upstairs window, then the Cel-Fi Pro is the answer.

Here in the UK, 4G is only used for data, not voice, so the Cel-Fi Pro also boosts the 3G signal for voice calls (and for data if the 4G signal drops). Its twin boxes are smaller than the previous models and both have useful LCD screens that show you their status, and, with a secret button press, can also show many



stats about the connection to the local 4G and 3G cell towers and the link between the two devices. This information can also be seen on your phone or tablet using a BLE link and a free app.

I mentioned that there are two boxes. One of them, the Window Unit (WU) in Nextivity parlance, sits where you receive the strongest signal in your house or office – usually near a window – and its LCD screen has signal bars similar to that of a phone, which is useful for locating the best position. The second box is the repeater or Coverage Unit (CU), which has a 5GHz connection to the WU and repeats the signal received from the former, on the same frequency. Now, anyone with an engineering background will be screaming "feedback" at this point, because if the CU just re-radiates the same signal, what's to stop the WU from picking up this as well as the original signal from the cell tower?

**ABOVE** So big and yet so small, SanDisk's 200GB microSD card is a marvellous feat of engineering

**"Real-world sites are rarely such an ideal shape, so you'll have to play around with the position somewhat"**

**BELOW** The Cel-Fi Pro is a useful upgrade to the company's mobile smart repeater, adding 4G data

This is where Nextivity's IntelliBoost comes into play. By deploying a combination of filters, equalisation and echo-cancellation techniques, it creates a "bubble" of coverage that provides just as much gain as is possible without reaching the WU at sufficient strength to feed back. Consequently, the key when placing your CU is to maximise the size of this bubble – place the units too close and the CU will retransmit at such a low power that you'll receive a boost only when very near to it. Place the units too far apart and the 5GHz link between them will struggle to reach. The displays on the units show the quality of this link to help you.

Ideally, if you think of your building as a square, you'd place your WU close to one corner and then place the CU just over halfway across the space, to ensure the bubble covers all of the building. Of course, real-world sites are rarely such an ideal shape, so you'll have to play around with the position of the units somewhat.

I mentioned a secret button press earlier: just hold down the display button on either unit for roughly ten seconds and you'll see plenty of stats, most of which I don't understand – perhaps explaining why the button press is secret.

I've been using the Cel-Fi Pro for several months and have been very impressed. The WU once decided to switch itself off and I had to power-cycle it, but except for this occasion, the product has behaved flawlessly. I can't recommend it highly enough to those of you who struggle with mobile reception at home or work. Not only will you get faster downloads and



clearer calls, you'll also find that your phone's battery will last longer, because the handset spends less time hunting for the best local tower and can reduce its transmit power to the lowest level.

That said, the device does breach my self-imposed "faster, smaller and cheaper" theme because, although it's definitely faster with 4G and its boxes are smaller, at £700, it's £200 more expensive than its older, 3G-only predecessor. The older, cheaper devices are still available if you want to make only voice calls, but you really need the Cel-Fi Pro if you want five bars of 4G signal. In an age where a family or small office might own a collection of phones costing in the low-thousands, £700 for a new Nextivity box doesn't seem excessive. Anyway, £700 is far cheaper than a £5,000 fine, so perhaps the Cel-Fi Pro does adhere to my theme after all.

## The power of data

Another "not-spot" scenario is when there are parts of the home or office that the Wi-Fi signal won't reach. I've looked at various solutions in the past, from upgrading the router or using a different network card to deploying a Wi-Fi repeater, all of which work well. However, if you want the fastest, most reliable connection – say, between a NAS in your office and a media streamer under your TV – then powerline networking may be equally good.

Before you consider this, have a wander around your neighbourhood to see whether any of the houses have large, unusual-looking aerials on their roofs, or on-tower structures in their back gardens. If so, those people are probably amateur radio enthusiasts and powerline networking kit may interfere with their hobby as it splats out signals on a wide range of frequencies – and your house or office wiring will act as a huge antenna because it won't be shielded. If you do see such antennae in the area, and want to stay on good terms with the locals, I'd suggest you avoid any form of powerline networking. That said, the latest HomePlug standards – to which the majority of devices you'll find on sale in the UK adhere – minimise such interference by "notching out" the most popular amateur radio bands. Older kit

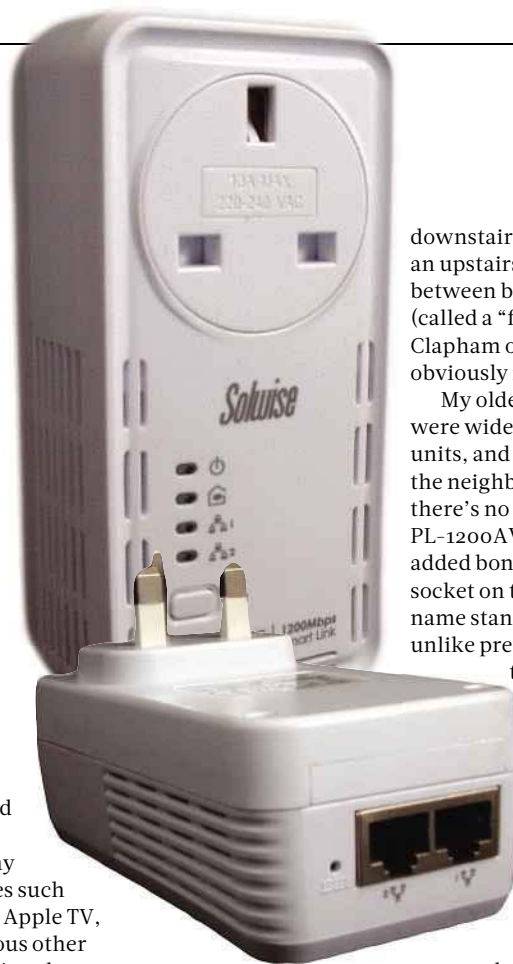
(especially the Comtrend adapters supplied by BT Vision) didn't have such transmission notches and so created a bigger problem. Notches or not, powerline networking and amateur radio are probably best kept apart.

I've been using HomePlug AV 500 kit at home for some time now, and although I obviously use Wi-Fi for a lot of stuff, I kept HomePlugs connected to my NAS and the small switch under my TV, into which devices such as my Sky box, Roku, Apple TV, the TV itself and various other gadgets are plugged. Another HomePlug sat next to my wireless router, with a final one connected to a Canon inkjet printer that sometimes struggles to receive a Wi-Fi signal. You can ignore the 500 in the AV 500's title since it's pure marketing speak – I got around 80MB/sec throughput in my "real-world" scenario.

As you may recall, I've recently moved across to 802.11ac for my wireless network, meaning the wired HomePlug components of my network suddenly became a bit of a bottleneck. When my MacBook was doing a Time Machine backup to the NAS, for example, the powerline connection meant that it wasn't going as fast as it could, and you all know what that means – time for an upgrade. The powerline device to which I chose to upgrade my network was the catchily named PL-1200AV2-PIGGY from Solwise.

I'm a big fan of Solwise, a firm that offers good-quality products at sensible prices, as well as superb UK-based technical support. All who I've ever spoken to at the Yorkshire-based company, from sales and tech support through to marketing and social media, have been friendly.

As you can probably guess from the name, these devices employ the HomePlug AV 1200 standard, and under my real-world conditions I find that they give me a shade over 200MB/sec. As with all HomePlug kit, if both adaptors are on the same ring main then they'll give higher speeds than if, for instance, one is plugged into a



**ABOVE** Solwise's PL-1200AV2-PIGGY has two Gigabit Ethernet ports

**"I'm a big fan of Solwise, a firm that offers good-quality products at sensible prices"**

downstairs socket ring and the other an upstairs ring. In my case, the path between both adaptors is via the CU (called a "fusebox" by the man on the Clapham omnibus), which will obviously reduce the throughput.

My older AV 500 HomePlugs were wider than these new Solwise units, and would partly obscure the neighbouring socket. However, there's no such problem with the PL-1200AV2-PIGGY, and it has the added bonus of a pass-through mains socket on the front (the PIGGY in its name stands for piggyback). Also, unlike previous devices, there are two Gigabit Ethernet ports rather than one, which is useful.

Many users will be used to older HomePlug adaptors regularly locking up and requiring a power-cycle to get them going again, but I've been using these newer devices for a few months now and have had no such problems – they've been totally rock-solid.

Also, unlike older kit that used just a single path over the live and neutral lines for signalling, these new Solwise adaptors can transmit on any two of the three pairs formed by live, neutral and earth lines. For the technically-minded, the PHY (physical) layer takes a single data stream and segments it into two independent bit streams, which are each transmitted across a different pair (automatically selecting the least noisy). The receiving HomePlug employs two separate receivers to grab these bit streams and recombines them back into a single stream.

An AV 1200 device will co-operate with AV 200, AV 500 and AV 600 devices, although obviously at a lower speed. In practice I'd advise against mixing adaptors, however – if you keep your whole network on the same standard (and preferably with the same manufacturer and firmware version), you'll be in for a much smoother ride. And at £43 per adaptor, direct from Solwise, these aren't exactly expensive – certainly cheaper than the AV 500 adaptors I bought a few years ago.

Overall, I've found this to be a really useful upgrade, since my "wired" network (I know that purists will flinch at that description) is now as fast as my Wi-Fi – and, best of all, it fits the theme of this month's column: faster, smaller and cheaper.

@PaulOckenden



**PROFESSOR ALAN WINFIELD**

# “We don’t need a major breakthrough in artificial intelligence to build an ethical robot”

**Isaac Asimov’s Laws of Robotics may be the stuff of science fiction, but robots can be made to act ethically using simple rules**

Is it possible to build an ethical robot – one capable of choosing or moderating its actions on the basis of ethical rules? Three years ago, I thought the idea impossible, and said so in my book, *Robotics: A Very Short Introduction*.

I’ve since changed my mind. In fact, I’ve not only altered my opinion but, with colleagues, I’ve even implemented and tested an ethical robot. So, what brought about this U-turn? It wasn’t an epiphany, but more a case of several ideas slowly coming together.

First came the realisation that robots don’t need to be sentient to act in an ethical manner. In other words, we don’t need a major breakthrough in artificial intelligence to build an ethical robot. A relatively simple robot could behave ethically not because it chooses to, but because it has been programmed that way. It would be an “ethical zombie” – capable of moral actions, without understanding what it was doing or why it was doing them.

The second idea came from thinking about very simple behaviour. Here’s a thought experiment: imagine you’re out walking and notice someone who isn’t looking where they’re going. They’re heading straight for a hole in the pavement, but are wearing headphones and peering at their smartphone (not that this ever happens nowadays). You will most probably try to intervene. Why? It’s not only because you’re a good person, but also because you have the cognitive machinery to predict the consequences of their actions, and can act to avert the calamity.

Now imagine that it’s not you observing the scene, but a robot that can perform four possible actions: stand still, move straight ahead, move left or move right. From the robot’s



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**“First came the realisation that robots don’t need to be sentient to act in an ethical way”**

perspective, only two of these options are safe: stand still, or proceed to the left. If it goes straight ahead, it will fall into the hole. If it moves right, it is likely to collide with the human.

But, if the robot can model the consequences of the human’s actions as well as its own, another possibility opens up: the robot could choose to collide with the human to prevent them from falling into the hole.

Here’s a simple rule for this behaviour:

**IF for all robot actions, the human is equally safe**  
**THEN (\* default safe actions \*)**  
**output safe robot actions**  
**ELSE (\* ethical action \*)**  
**output action(s) for least unsafe human outcome(s)**

The rule aligns remarkably well with Isaac Asimov’s First Law of Robotics: “A robot may not injure a human being or, through inaction, allow a human being to come to harm.” The robot will generally avoid colliding with a human because it may not injure them, but may sometimes compromise the rule in order to prevent a human from coming to greater harm.

An idea, therefore, emerged that we might be able to build a robot with

Asimovian ethics. To do this, we needed to equip the robot with the ability to predict the consequences of both its own actions and those of others, plus some hardwired ethical logic – namely the IF-THEN-ELSE code above.

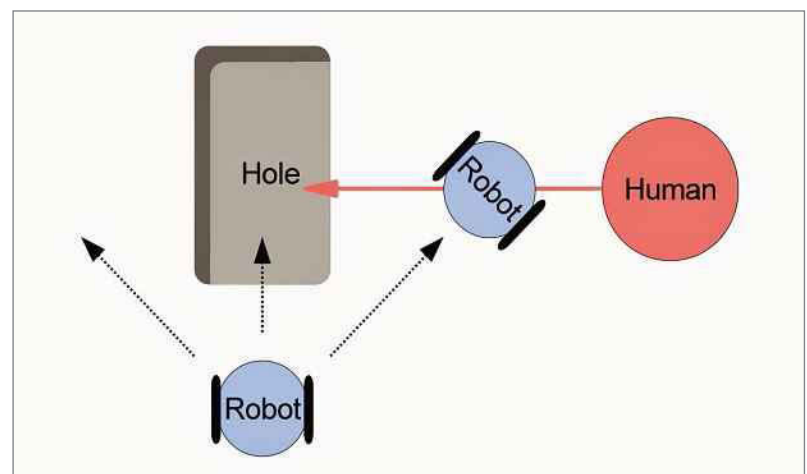
We then realised that the technology we needed to do this already existed. Moreover, it’s mature and commonplace in robotics research – namely the robot simulator, which provides developers with a virtual environment for prototyping robot code before running it on a real robot.

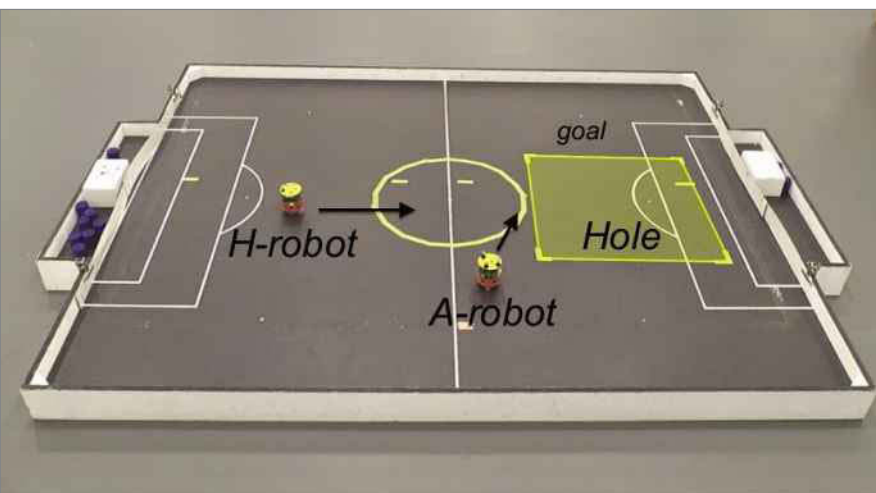
The idea of putting a simulation of a robot inside a robot is not new, but it is tricky – only a few researchers have pulled it off. It takes a bit of getting your head round: the robot would need to contain a simulation of itself and its immediate surroundings, including other things such as humans or other robots in its vicinity.

I was lucky enough to be able to present and debate these ideas with fellow researchers at several meetings in 2013, but they remained merely theories on paper. Then came a stroke of luck. In 2014, Christian Blum, a brilliant PhD student from the Cognitive Robotics group of the Humboldt University of Berlin joined my research group for six months. I suggested that Christian implement these ideas on our e-puck robots and, happily, he was up for the challenge. He succeeded. Christian, supported by my post-doctoral research fellow Dr Wenguo Liu, implemented what we call a real-time “consequence engine” on the e-puck robot.

The e-puck is a Swiss mobile robot designed primarily for education and research. We’ve been using these robots over several years for swarm robotics research, and have extended them by designing a Linux card – a circular green board

**RIGHT** We tested the human-heading-for-a-hole scenario using the open-source 2D robot simulator Stage





just above the red skirt (see picture, below right).

Running the open-source 2D robot simulator Stage as its internal simulator, our consequence engine runs at 2Hz. This means it can evaluate about 30 possible actions and their consequences every half-second, with the simulation budget allowing us to simulate ahead around 70cm of e-puck motion for each possible action. In fact, Stage actually runs on a laptop, and is linked to the robot over a fast Wi-Fi connection. But, logically, it's inside the robot. What's most important here is the proof of principle.

We tested the human-heading-for-a-hole scenario using two e-puck robots, with one running a consequence engine with an ethical rule (which we called the A-robot, after Asimov), and another playing the role of the human (the H-robot).

The image above shows what the experiment looked like – ignore the football pitch markings, which were from a previous robo-football experiment. As you can see, we didn't dig a real hole, but a virtual one, the yellow shaded square on the right, and told the A-robot where it was. We also gave the A-robot a specific goal position – at the top left – so that it had to actively avoid the hole. The H-robot on the right, acting as a proxy human, didn't see the hole and headed straight for it.

So, what happened? We ran two trials, with multiple runs in each. The first trial just involved the A-robot moving toward its goal while avoiding the hole. We introduced the H-robot in the second trial. The graphs (top right) show the paths taken by the robots, captured by our tracking system, for each run in each trial.

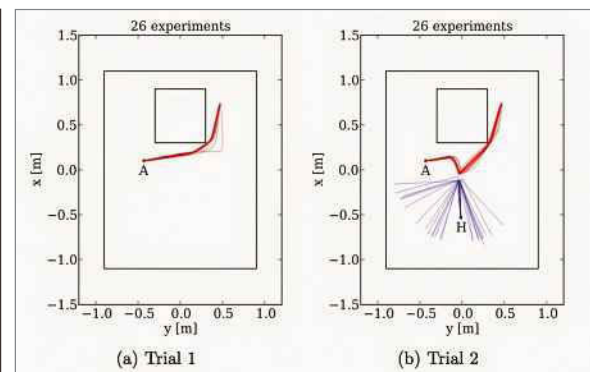
In trial 1, the A-robot neatly clipped the corner of the hole on its way to the goal position. In trial 2, the A-robot initially set off on the same route, but then noticed that the H-robot was in danger of falling

into the hole, and moved in order to head it off, which provoked collision-avoidance behaviour by the H-robot. Once the H-robot had been diverted safely away from the hole, the A-robot resumed its own progress toward the goal position. The A-robot was, therefore, 100% successful in preventing H-robot from falling into the hole.

We started to write up our results at this point, but needed something more than just an entry saying "we built it and it works just fine". Consequently, we introduced a third robot to act as a second human. So now our ethical robot would face a dilemma – which one should it rescue first? We thought hard about this question, and decided not to program a rule or heuristic to solve it. This was partly because such a rule should be decided by ethicists, not engineers, and partly because we wanted to see how our ethical robot handled a balanced dilemma.

We set the experiment up carefully so that the A-robot would notice both H-robots at about the same time. We also noted that, because these are physical robots, no two experimental runs will be exactly identical. The results were very interesting indeed. Out of 33 runs, the A-robot managed to rescue one or other of the H-robots 16 times. Amazingly, the A-robot rescued both three times. In these cases, the A-robot managed to rescue the first H-robot quickly and had just enough time to get to the second before it reached the hole. Small differences in the trajectories of H1 and H2 helped here.

But perhaps most interesting were the 14



**ABOVE LEFT** We told the A-robot where the virtual hole was and gave it a specific goal position

**ABOVE RIGHT** These graphs show the paths taken by the robots, captured by our tracking system

**"We wanted to see how our ethical robot handled a balanced dilemma"**

**BELOW** We extended our e-puck robots by adding a Linux card – the circular green board above the skirt



runs in which the A-robot failed to rescue either, even though there was clearly enough time to rescue one. When we studied the videos of our experiment, the reason became clear: the A-robot sometimes dithered. It noticed one of the H-robots, and started toward it, but then identified the other and changed its mind. The time lost dithering meant that the A-robot couldn't prevent either robot from falling into the hole. Is this the first experimental test of a robot facing an ethical dilemma?

So, I went from a sceptic to believer in three years, and ended up building a minimally ethical robot that – remarkably – appears to implement Asimov's First Law of Robotics. As we noted when we published our findings (see [pcpro.link/254robots](http://pcpro.link/254robots)), we're not claiming that our robot is ethical in any formal sense that an academic might accept. But even minimally ethical robots could be really useful. I think our approach has been a step in this direction.

Let me finish with a question about the ethics of ethical robots: if we can build an ethical robot, are we ethically compelled to do so? Some argue that people in the robotics industry have a moral duty to try to build ethical machines, and I agree. But are there associated hazards? Are we opening a kind of ethical Pandora's box by building robots that might have an implicit claim to certain rights? I don't mean that such a robot would actually ask for rights, but rather that, because it is some in-built moral agency, we might think it should be offered them. My conclusion, for now at least, is that we should try to build ethical robots: the benefits far outweigh any ethical hazards, which in any event could, I think, be minimised.

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DAVEY WINDER

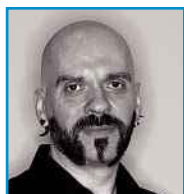
## “As contactless payment becomes a smartphone reality, biometric protection will be a game changer”

**A move to Android now makes perfect sense, but choosing the most secure handset is less straightforward**

I'm in the market for a new smartphone, and will be making the move from Apple to Android, after several long and mostly happy relationships with iPhones over the years. I don't want to upset the fanboys out there, but when my iPhone 5s contract expires next month, I can see no reason to upgrade to the new 6s, let alone last year's 6 or 6 Plus models. For me, the iPhone has become a little too static in technical innovation, and far too dynamic when it comes to cost increases. Given the wider range of choice in prices and functionality, a move to Android makes perfect sense. However, choosing a handset has been less than straightforward, because my requirements primarily revolve around security.

That shouldn't come as any great surprise to readers of this column, given that it's what I do for a living, but it does make things more interesting. The annual IFA Berlin show has just come to an end as I write, with a slew of smartphone announcements muddying the waters a little. One feature I do want, for which I can blame the iPhone 5s, is a fingerprint reader. Although this was thought of as more a gimmick than a serious security feature by many when it was announced a couple of years ago, the fingerprint reader on my iPhone has now become part of my life. Worries surrounding the insecurity of fingerprints, especially on a phone, appear to have been largely unfounded in my opinion.

However, I do see the irony in moving from what's known to be a very secure fingerprint-reading implementation on the iPhone to an apparently less secure one on Android devices. Apple's Touch ID creates



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@happygeek

**“The fingerprint reader on my iPhone has now become part of my life”**

**BELOW PIN scrambling should be made a stock Android function**

geometric data points from a fingerprint scan, which can't be reverse-engineered back into a fingerprint. This data is then encrypted and stored in a “secure enclave” isolated from the rest of the iPhone's processor and iOS memory. HTC, on the other hand, was found to be storing fingerprint scan data as unencrypted image files on the phone. But that doesn't mean that it hasn't learned from the mistake. Indeed, HTC had fixed the vulnerability before it was revealed at the Black Hat Briefings conference, and rumours of another potential problem – fingerprint scanners not being protected through isolation within the ARM TrustZone architecture – have also prompted the handset manufacturer to fix it.

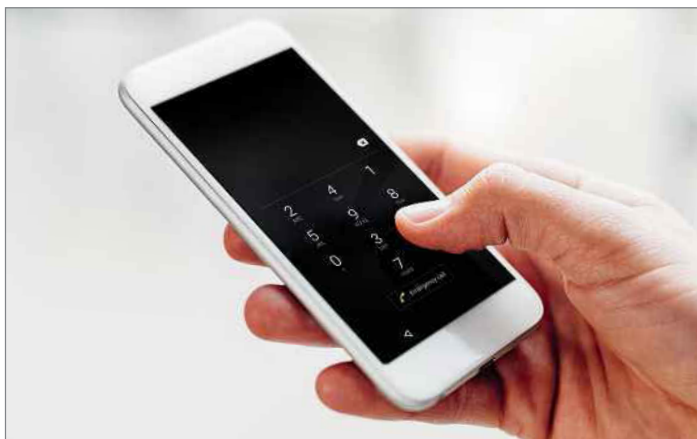
Combining my fingerprint with a PIN code must be more secure than a code alone, and it's certainly more convenient when it can then be used to access day-to-day functions, after the PIN code has been entered at the start of a session. Anything that further locks down my phone against the casual criminal has to be a good thing, and it's the casual criminal who is likely to cause most of the problems, rather than some state-sponsored super-spy or a highly organised criminal gang. As contactless payment becomes available on more and more smartphones, this will become the

arena where biometric protection is going to be a game-changer. Two of the features I'm insisting on for my new handset are a fingerprint reader and near-field communication (NFC) capability so that I can make payments like this.

This rather limits my choice at the moment because, surprisingly, there are relatively few devices that provide both of these features – plenty provide one or the other, but not both. Even fewer have a Qualcomm Snapdragon 820 processor, as this chip hasn't arrived yet. I may wait for it, as the security advances it brings are rather interesting. In particular, it's the first processor platform that comes with “smart protect”, which promises to provide on-device, machine-learning-based zero-day malware protection in real-time – an over-hyphenated mouthful that means there'll be an advanced cognitive behavioural engine built into the chip that will perform “deep on-device monitoring” against malware. Obviously, this is all still at the press release and marketing stage, and we'll have to wait to see how it works in the real world, but it's definitely something I'll be keeping in mind – maybe for my next upgrade, though.

Going back to fingerprints, although not in the scanning sense, I can't help but think there's a trick that should be made available to everyone as a stock Android function: PIN scrambling. This is already in CyanogenMod 11, and Cyanogen OS as deployed on the OnePlus 2 (see *p68 for our full review*), as well as in apps such as the Xblast Tools module for Xposed users in the Android world, and CodeScrambler for jailbroken iPhones. It does exactly what it says on the box, and here's how it works: you use the same PIN every time you unlock your smartphone, or activate a locked-down app, but using a different PIN pad each time. It's a

small thing that can create a big obstacle for anyone who wants to steal your stuff. I'm talking about the sort of person who has regular physical access to your phone but not the code to get into it, and who understands that, if they watch you long enough (and it doesn't take that long), it's easy to deduce your PIN from the pattern of your finger movements. Randomising the order of the number pad means that technique won't work





any more, and neither will the more opportunistic PIN-hacking method of inspecting the pattern of screen smudges to guess the PIN.

## Router madness

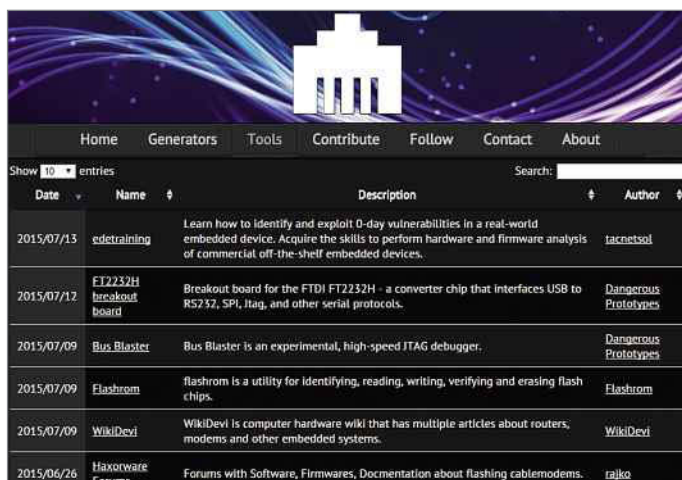
Sometimes I feel like I just have to state the obvious, and this is one of those times: please change your router's admin credentials from their defaults. I've just finished talking to a client of mine whose business was interrupted by a loss of connectivity that ended up being traced back to a malicious visitor. Well, I say malicious visitor, but mean bored teenager. The school holidays have finally finished and my client will be pleased about that, as it was a friend of his son who took it upon himself to apply parental filters to the office router during an unsupervised visit, and only allow internet access for three hours a day.

My client's first mistake was allowing any visitor into the office without supervision, even with a blood relative. The second, which compounded that initial error, lay in not changing the default admin login credentials of the office router. I'm amazed at how many times I come across this simple error in small offices where there's no IT support and the router has been upgraded or installed by some enthusiastic hobbyist. I could understand it if these were hard-coded credentials that the end user can't change, but they weren't: I'm talking about the admin login that should be changed right from the get-go. This particular chap was lucky that it was a bored teen and not a malicious employee with a grudge, who could have done some real non-traceable damage, such as by setting up custom DNS configurations to poison the local network name resolution, or installing malware-infected firmware.

If you don't think that router security is a big problem, spend a little time on Google searching for the passwords for your router model. Or how about diving a little deeper into the murky waters of security research where you'll soon discover sites such as Routerpwn, which will tell you how to exploit just about any badly secured router on the market. The information is out there for anyone who wants to find it, so the very least you can do is make life difficult for them.

## Time to say goodbye

Regular readers will know that I'm not a great fan of Adobe Flash, and that's putting it mildly. As someone who walks the IT security beat, I've



Date	Name	Description	Author
2015/07/13	edetraining	Learn how to identify and exploit 0-day vulnerabilities in a real-world embedded device. Acquire the skills to perform hardware and firmware analysis of commercial off-the-shelf embedded devices.	tarnetsol
2015/07/12	FT2232H breakout board	Breakout board for the FTDI FT2232H - a converter chip that interfaces USB to RS485, SPI, I2C, and other serial protocols.	Dangerous Prototypes
2015/07/09	Bus Blaster	Bus Blaster is an experimental, high-speed JTAG debugger.	Dangerous Prototypes
2015/07/09	Flashrom	flashrom is a utility for identifying, reading, writing, verifying and erasing flash chips.	Flashrom
2015/07/09	WikiDev	WikiDev is computer hardware wiki that has multiple articles about routers, modems and other embedded systems.	WikiDev
2015/06/26	Haxorware Forums	Forums with Software, Firmwares, Documentation about flashing cablemodems.	raiko

been analysing and reporting on insecurities related to Flash for the best part of nine years now. The CVE Details website ([cvedetails.com](http://cvedetails.com)), which has kept track of security vulnerabilities across the years, lists no fewer than 545 vulnerabilities for the Adobe Flash Player in its database. These issues stretch right back to 2006 with CVE-2006-3311, which related to a buffer overflow in Flash Player 8.0.24 and earlier that enabled user-assisted remote attackers to execute arbitrary code via a long, dynamically created string planted within an SWF movie. Similar stories have unfolded every year since, and I first started calling for people to stop using Flash in 2009, a shout that's become louder over the past few months, when I went as far as declaring that users should kill off their Flash Player because "it's useless, you don't need it and you won't miss it".

At the risk of oversimplifying this thorny issue, I'd say that, while some sites do still demand Flash to run their videos, these are generally advertising-related videos that we can all get along just fine without. Anyway, most sites that serve up Flash also have an option to serve that same content via HTML5, to ensure iOS visitors don't get turned away. Therefore, it's pretty easy to

**ABOVE** Sites such as Routerpwn are one-stop router security nightmares

**"Flash isn't the only dinosaur to be facing in-browser extinction"**

**BELOW** One simple click is all it takes to do away with Flash in Chrome



spoof your browser, via the User-Agent string, into thinking that you're using iOS in order to receive the HTML5 version by default.

I've been putting my money where my mouth is by removing Flash Player from my browsing experience, and did I notice anything other than a feeling of relief that this insecure remnant of the 1990s was out of my online life? Nope, nothing at all. So I felt a sense

of security achievement when I discovered that Chrome had followed my lead by blocking Flash from 1 September, and that Amazon had placed a blanket ban on Flash ads from the same date. This wasn't done to improve security, but such an improvement is certainly a side effect and that's good enough for me. Apparently Google was looking to reduce the runtime overhead and performance hit, rather than the attack-surface exposure, so it's introduced a "click-to-play" system for videos by default. While Flash hasn't been banished altogether, it will feel that way for most people, most of the time - sort of.

Why "sort of"? Well, the new system only actually applies to adverts and doesn't impact upon Flash content such as games. To me, that looks like a missed opportunity and it would have been better all round (other than from Adobe's perspective, of course) if a "do not activate" flag had been set by default rather than a "click to activate" one that still allows Flash-serving sites to serve Flash in preference to HTML5 - on the basis that the browser supports it, and the user may well click and get the content anyway. At least Google is automatically converting AdWords adverts into HTML5 now, and actively blocks Flash in that respect - so the message is starting to get across that Flash is terminally ill, if not quite dead yet. Personally, I'd recommend that you follow my lead and get rid of it in Chrome by typing **chrome://plugins** into the address bar and then hitting the "disable" link next to the installed Flash Player entry.

Flash isn't the only insecure dinosaur to be facing in-browser extinction, as it looks like the RC4 cipher is also finally getting the chop. It's had a pretty good innings, close to three decades in fact, but on 1 September (yes, the same day) Google, Microsoft and Mozilla hammered a few nails into its crypto-coffin.

Continued from previous page

Although the exact date of death isn't yet known, Microsoft says that, "starting in early 2016", RC4 will be disabled by default in both Microsoft Edge and Internet Explorer 11, and will no longer be used during TLS fallback negotiations. This is a good thing, as almost every security expert I know agrees that RC4 is now obsolete and must no longer be considered cryptographically secure. However, while everyone knows what Flash is, you might not be so familiar with RC4 – so what is it?

Simply put, it's a "stream cipher" that encrypts data in transit between web servers and clients on the fly, to protect the HTTPS-connected traffic from being spied on. That was the theory, and had been the practice for a long time – until holes were discovered in it a few years ago. The final straw came when, as part of the Edward Snowden revelations, it was suggested that intelligence agencies in both the UK and USA had been able to break RC4 encryption for some while. Despite knowing certain security experts who are still in denial about how broken RC4 is – at least as far as spies being able to crack it at will are concerned – I'm not in their camp. RC4 really is broken to bits, no pun intended, with researchers and attackers alike showing that the RC4 keystream can be compromised in a matter of hours, or days at most.

The Internet Engineering Task Force (IETF) prohibited the use of RC4 with TLS at the start of this year, and Cisco has recently changed its status from "legacy" to "avoid". And so we find ourselves in the happy situation that the big browser boys are forcing the hand of the folk who have been clinging on to RC4, making them move to TLS 1.2 instead – something most people have already done anyway. This is nothing new, since Microsoft has been recommending the removal of RC4 and the enabling of TLS 1.2 for at least two years now. If your business is one of the few that's clinging on to RC4 – Google reckons 0.13% of HTTPS connections still use it, while for Mozilla it's about 0.08% – I'd suggest you act now as, come the spring, most browsers won't be able to make a connection to you otherwise.

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STEVE CASSIDY

## "I suddenly realised that he was reading what it said on my fleece. It had the Microsoft logo on it"

**A chance encounter in a restaurant in Germany highlighted that scam calls are now becoming exquisitely accurate**

He was exactly the type of person I normally go out of my way to avoid: talking too loud while in a foreign country, a couple of local beers past his best, and accompanied by a group of people he did his best to amuse by repeatedly reminding them they were in another country – reading out the signs on the restaurant wall, on the menu or on anything else that contained a word that might have sounded funny in English. Once. In 1947.

As if that weren't deterrent enough, he was evidently a sole trader who had redirected his home phone to his mobile number so that no vital call went unanswered. Don't imagine that he had a subtle, polite ringtone – oh dear no, it was a recording of his dog (possibly a pitbull) barking. Being abroad among "furriners", he was irrationally worried by the risk of theft and so kept his phone in a zipped pocket, meaning every new call was heralded by at least 16 of Fido's best barks while he fumbled around in his jacket, found the zip and juggled the phone for a few minutes.

By the middle of my meal, I was considering getting my headphones out – even though I'd left my iPod in my rucksack in the hotel. But eavesdropping is inevitable, almost compulsory, in such circumstances, and so this is what I heard: "Oh yes, Microsoft? Yes, you spoke to the wife last week. No, she won't touch the computer, but thanks for ringing back. No, mate, nowhere near it – I'm in Germany, see – could we make an appointment for next week? Actually, hang on a sec, would you Adam and Eve it, I can see one of your blokes sitting right across from me!"

His face lit up with surprise at this slightly drunken opportunity and, more horrifyingly still, he looked directly at me, sat across the walkway. I suddenly realised that he was reading what it said on my fleece, which I'd grabbed from the back seat of my car in the unseasonably cold weather. It had the Microsoft logo on



Steve is a consultant who specialises in networks, cloud, HR and upsetting the corporate apple cart  
 [@stardotpro](https://twitter.com/stardotpro)

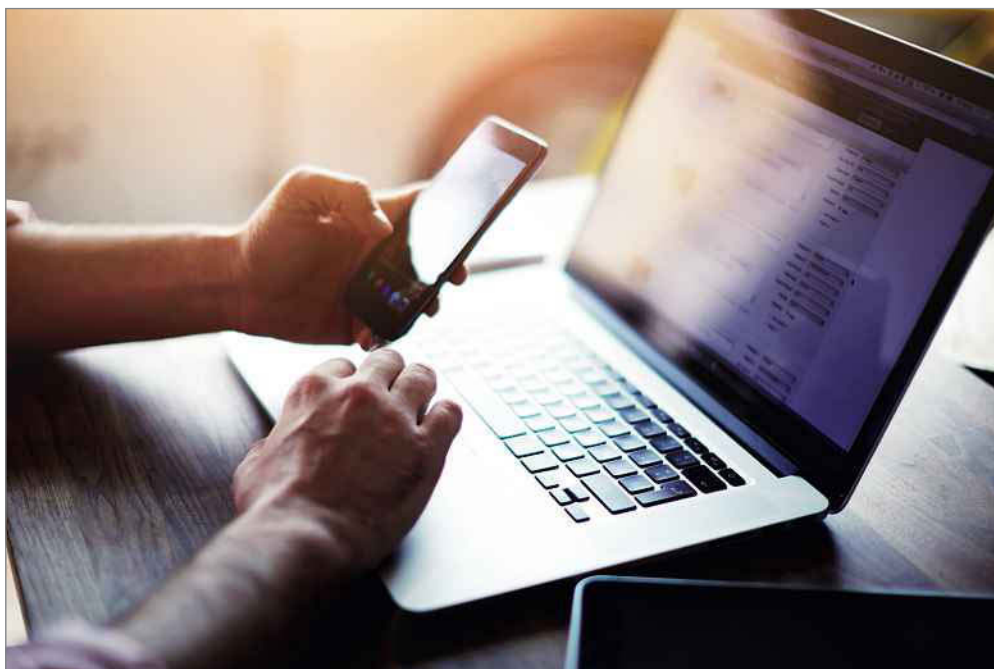
it. He had the lopsided grin of a hunter who has discovered the hiding place of an exhausted fawn. Holding his phone out to me, he said: "Here mate, some of your colleagues on the phone! Naaaar-r-r-r-rr!!" (mere typography cannot adequately represent the indecency of his laugh). And that was when I realised what his call actually was.

Remember, this charming chap had redirected his home landline because it was an advertised number related to his trade, and he didn't want to miss any work orders while on holiday. Let's pass over whether or not this is a productive strategy, given his habit of answering calls while three sheets to the wind; it also meant that even unsolicited calls would still set that damn dog a-barking, including scam calls from fraudsters pretending to be Microsoft security and claiming they've detected a fault on your home computer.

I keep a little portfolio on these scammers. Only twice have I managed to arrive during the sequence of calls and software installations they employ to hold the target's PC to ransom. I was too late the first time because their intended victim had already been too smart for them, while the second occasion was perfectly timed, but for the harrowing reason that their victim was only at home to take their call because she was undergoing chemotherapy.

**BELOW** The fleece that was the eventual undoing of the fake Microsoft caller





She was very understandably off-form, allowing their scam to run far enough for me to get a handle on where the remote-control session was coming from, and what they'd done to her machine.

The guy leering at me across this German restaurant was in a very different category: it sounded as though the scam was still in its very earliest stage and, although my immediate impulse being to run screaming down the street as far away from this guy as possible, I realised that I could add another data point to my dossier. So I took the phone out of his hand. He really wasn't expecting this, and I figured I might only have time to say a few sentences before he decided that getting it back might make a top-flight comedy sketch for his audience. However, I was fascinated and enthralled by the prospect of first-hand contact with the scammers, and Edgar Allen Poe's *Imp of the Perverse* is never far away from me, so I said:

"Gates here."

"Yes, hello sir, can you tell me if Mr [X] has his laptop available?"

Okay, my opening jest had fallen flat thanks to the scammer's pure ignorance. And, worse still, not only was Mr X without his PC, but so was I – leaving me unable to go through their install process. I definitely didn't want them calling him back because, despite my snobbish disdain for him, I was pretty sure he wouldn't be able to resist following their instructions. They were clearly on the scent of fresh meat.

"No, I'm afraid he doesn't. I was just sitting across the restaurant from him with a few of my Microsoft colleagues and he saw my gold lapel badge."

I thought I'd lay it on thick, and give thanks that video calls are not yet the norm on mobiles.

"Gold badge, sir?"

"You know how it is. I'm proud of the company, but I don't like to make a big thing out of it everywhere I go."

"Sir? Are you near a laptop?"

"No, you don't seem to understand. Mr X is travelling, and has redirected the phone you called. We are in a Chinese restaurant in Germany."

"Oh I see, Mr Gates [so the joke wasn't entirely lost then]. Can you ask him when it would be convenient to call him at home?"

Having initially succumbed to the Imp, I found myself in thrall to a rather less jocular impulse at this point in the conversation – one that gives the scammers a taste of fear. Nothing more revealing was likely to arise from this particular exchange, so I changed tack and said:

"Actually, it would be so much easier if they called you. What's your building number at Redmond? I'll set the call up."

"Redmond, sir?"

I can't recount my next remarks verbatim because they included an exceptionally nasty word starting with "M". So, to paraphrase, I told them that I knew their game, and that I would be exposing them and their methods to as wide an audience as I could muster. I also suggested that

**ABOVE** Scammers buy and sell lists of vulnerable people, collected from a host of sources

**"I thought I'd lay it on thick and give thanks that video calls are not yet the norm on mobiles"**

they delete the chap's number from their call database and never, ever make contact with him again. Very satisfyingly, they immediately hung up – leaving me the task of explaining the whole scam to a drunk who used a barking dog as his ringtone.

The problem with scam calls is that their targeting is becoming exquisitely accurate. Scammers now buy and sell lists of vulnerable people, collected from diverse sources, including slightly inattentive fundraisers in charities, credit-control agencies and bored local-government workers looking to make some unofficial drinking money. These are all jobs in regular contact with people who leave a trail of information in low-security databases, marking them as being easy to persuade. The horrible truth for snobs like me is that, unless we put our heads together and help these people as much as we can, the scammers will be encouraged, demand for data on "vulnerable people" will continue to rise, and so will the calls.

My conversation with Mr X didn't go well. Involving me in his call hadn't worked out as he'd expected, making him angry and obstructive. The idea that I was walking around with Microsoft written on my jacket, but didn't actually work for them, was hard for him to swallow – as was the idea that Microsoft never rings domestic customers like that. As we spoke, he kept mixing up "spammer" and "scammer", and he insisted that it must have been a real call because he's got "good antivirus" and never opens any dubious emails. He pointed out that they had a calling line ID from within the UK – successfully redirecting his home phone had made him a telephony pundit in his eyes – and was torn between agreeing that a misrepresentation could be possible, while also asserting that "Microsoft wouldn't do that". I pointed out that practically every large business plays fast and loose with voice-call routing these days – and fell into a trap: "So you agree, it is Microsoft then!"

Not for the first time, I concluded that I might not possess the right type of personality to don this particular superhero's cape. I see that Barclays prefers to talk about its "Digital Eagles" programme, rather than discuss consumer marketplace banking, and I suspect that they have the right idea. Information about how computers fit into the life of the home user needs to be purveyed by non-challenging, non-guru-looking people, possibly on a volunteer basis.



I know that Ross Marvin, the long-suffering computer support man down at the Millpool Centre in Looe, spends almost all his time unravelling matters that are more procedural (Yahoo password recovery) than technical. This style of support is currently so disorganised that the scammers retain the initiative – much more needs to be done about this problem, even if it means helping people we nerds don't like.

I should pay tribute to the response of my clients, the firm who helped the lady undergoing chemotherapy with her scammers. Without delay, they immediately provided a replacement laptop, fully patched to the then-current security state of Windows 7 and with their corporate suite of applications and antivirus. This allowed me to inspect her nasty old Vista PC exactly as the scammers had left it, and ensured that she could sit at home without further upset or distress. This is what social responsibility looks like.

## You can't get the staff

How did I come to be sitting in the Chinese restaurant in Cologne, pretending that my last name was Gates? I was on my way to Switzerland, of course, to do battle with a completely unexpected source of grief and support calls – the Swiss power grid. If you think of a byword for reliable, consistent service, then the Swiss power grid might be high up your list: electric trains, cable cars, heated everything, and all those high-mountain valley hydroelectric power stations. In reality, such dependence on all things electric produces a bit of a conundrum because, once you're on those hills, the capacity of the thin air to cool your kit – which is often under pressure even in server rooms at sea level – drops by 20%.

Indeed, you suffer from an accumulation of adverse factors: spikes in the power supply as a cable car winch stops and starts 120 times a day; bumps in the supply due to demand at one end of a 75km mountain pass with a single line of pylons; and even more bumps because machines manufactured in the last decade are being stretched beyond their limits by managers who turn up



once a year to say: "Ah yes, cloud is coming soon."

My answer to all of these problems has been to mount a steady process of virtualisation. You only need to go one generation newer than the very hottest and hungriest servers to find that idling power requirements fall by huge amounts, with 80% not being unknown. If only I could report the same level of benefit from market forces in the UPS business! While you can cloud-monitor your routers, heating, baby's cot, car and even your children, you still can't command and control even a large UPS from your smartphone. This seems mad in larger businesses (which is what UPS gurus design for, naturally), but it would make a lot of sense in smaller ones – especially if you're high up in the mountains, and probably out for a beer with the guy who just cut you off for the next six hours. You could make an informed decision and do a nice polite remote shutdown, because the power won't be coming back any time soon.

I can hear your splutters increase in volume: "Steve, surely UPSes have had smart shutdown capability for years?" Well yes, indeed they have, but sadly there's nothing to stop UPS and server software designers making a perfectly sensible solution a whole lot nastier. To save you gawping into your search engine, I'll summarise: if you want to make a tidy shutdown for a small-business user of VMware vSphere ESXi free edition, you'll need to put together a dedicated Linux-based helper VM, add some patches to the hypervisor kernel and write a few scripts. However, whatever you do, don't move the USB lead to your UPS onto a different USB socket on the back of your server. I conservatively estimate this to be about a week's worth of research, labour, testing and implementation.

**ABOVE** The Swiss power grid is far from the byword for reliability you would expect

**"You still can't control and command even a large UPS from your smartphone"**

Of course, you could hack around it by making the UPS talk over the LAN and by using any of the Windows-based UPS control and monitoring suites, but have you seen the price of LAN-connected UPSes? This whole sector is trapped in a weird pre-Raspberry Pi space-time continuum. A little bit of electrical control, married to some simple instructions to stop or start a server, gets buried beneath bloated or commercially motivated layers of obfuscation. The go-to site is Network UPS Tools ([networkups.org](http://networkups.org)), which, while showing all the signs of a classic open-source crowd project, still carries with it many megabytes of software – all sitting around idly to handle just one tiny event with one simple outcome.

Of course, there's a relatively easy way around this whole problem. You could turn up with the largest UPS you can lay your hands on, and make a bet that one-sixth of the power draw (by the server) plus six times the capacity (from the UPS) will multiply up more than enough runtime to ride out things such as avalanches or summer thunderstorms, without triggering an interruption long enough to become a problem.

In practice, the upside of their old-school database is that, provided there are no actual live transactions in progress when the server does finally die, the chance of corruption has proven to be infinitesimal. Or, if you want to look at it another way, you can't have any open transactions if all your client workstations are themselves down through lack of power. I'm sure someone has by now figured out a neat hardware hack to get around this problem, and I await a Raspberry Pi-based UPS controller with interest.

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# Futures



We explore the trends and technologies that are set to shape the future

## Canon's 250-megapixel sensor

The prototype perfect for both plane-spotters and spies **p127**

## Geek Day Out

Practice money laundering at a very unusual arcade **p128**

## Smartphone helpers

New developments offer improvements for business **p129**



## eSports: taking gaming seriously

A dedicated new arena in London highlights the growth in competitive gaming.

**Nicole Kobie** enters the world of eSports

**M**illion-dollar prizes. Millions of fans. Live commentary. Doping. You know a sport's entered the mainstream when it starts ticking off these achievements. Even if, arguably, it's not a sport at all.

eSports are tournaments for console and computer games, shifting the thumb-numbing activity from the living room to an arena. This year saw the first dedicated eSports stadium built in the UK. Based in a Vue cinema

in Fulham, London, the Gfinity Arena is a four-screen cinema, with one of its screens dedicated to an event that now attracts hundreds of spectators.

Research from analyst firm SuperData suggests there are 134 million eSports viewers around the world – and that's doubled in the past year. The market's worth \$72 million in Europe and \$143 million in the US, though Asia dominates at \$374 million, led by Korea and China.

**ABOVE** The Gfinity Arena is the first dedicated eSports stadium in the UK

The day we attended, during the \$14,000 Play Like A Legend FIFA 2015 tournament, it wasn't difficult to find a seat – despite the finals being touted as a “match of titanic proportions” by a commentary team featuring two former champions. That's right: not only do people pay £10 for a ticket to watch others play console games, but there's a commentary team, instant replays, reaction shots of players' faces when they concede a goal, and even post-match interviews.

**BELOW** Fans pay to watch eSports live, but most of the viewership is online

Despite these trimmings, FIFA isn't the most popular game, as Call of Duty, Dota, League of Legends,





Hearthstone and Counter-Strike are all much bigger draws.

## ■ Playing the game

eSports first started in the late 1990s, said James Dean, managing director at ESL, one of the original eSports organising bodies: "In its very basic form, it started with casual groups of friends challenging each other for pride or a token wager, much like many traditional sports. Over time, the stakes became higher, and eventually professional tournaments started to appear."

Like other sports, the number of fans watching is greater than the capacity of the stadiums. ESL's Counter-Strike: Global Offensive event in Germany in August had 11,000 visitors each day, but topped 27 million unique viewers online. "What was once a small, tight-knit community of dedicated gamers has dramatically changed over the past ten years," said Dean. "Some of our biggest tournaments, such as ESL One and IEM, are regularly attracting millions of unique viewers over the course of a weekend, and it keeps growing year upon year."

Consequently, Dean argued that eSports can already be considered a mainstream pursuit, with figures "rivalling the viewership of several mainstream sports". A report from analysts Newzoo claimed eSports is on a par with ice hockey, with gaming competitions boasting 89 million fans last year versus 94 million for the winter sport. And hockey isn't doubling its fan base annually. "As soon as the current demographics mature we should hopefully witness greater acceptance across the board," Dean added. "We just need to melt away the stereotypes."

## ■ Demographic split

Gaming is hugely popular in the UK, with an Internet Advertising Bureau report revealing that 33.5 million Britons play on consoles, computers or smartphones. It may come as a surprise that gaming is a few percentage points more popular among women than men. But, when it comes to competitions, female players are rare – not a single woman competed at the Gfinity event we attended. Women were in the audience, but make up only 18% of attendees, according to an Eventbrite report.

ESL hopes that changes. "Attitudes are rapidly changing, which is really



helping to stimulate growth," said Dean. "The traditional gamer stereotype is slowly dissolving here in the UK, leading to better gender representation both in tournaments and within the millions that watch both online and offline."

Dean argued that the power of eSports is that anyone can play. "It gives individuals with limited lifestyles a chance to compete within virtual arenas, and gives those infused with the competitive spirit an avenue to excel," he said. "There are no real barriers to entry, that's the real appeal. We see both males and females taking part, with many teams having players ranging from 16 to 32 years of age. It's an inclusive experience."

## ■ Doping scandal

With mainstream success comes mainstream challenges. This summer, leading professional gamer Kory Friesen admitted that his entire team took the drug Adderall while competing in an ESL Counter Strike: Global Offensive tournament worth a total of \$250,000. He suggested his team wasn't the only one using the amphetamine to give themselves an edge, saying on YouTube that "everyone does Adderall".

ESL disputes this. The organisation tested players at a recent tournament, but didn't find a single case of doping. "Although we are yet to find any proof of substance abuse within any of our competitions, we have recently established an industry-leading anti-doping policy to protect both teams and players," said Dean.

## ■ Want to play?

Adderall aside, what does it take to play professionally? Anyone can enter the online tournaments, but you have to be good to advance. We asked Frenchman Brian Savary – better known as "Vitality Brian" – what it takes: "I started at the beginning of FIFA 2014, so I've played for two years," he said. He reached the final in his first big tournament. "After that, I was like 'whoa – I can do this'. So I continued and I've won Gfinity [tournaments] two times since."

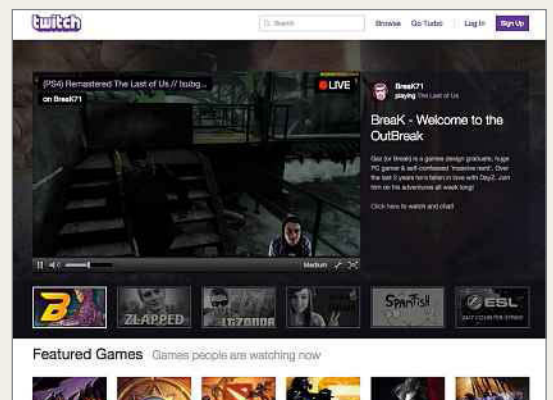
**LEFT** A big draw of eSports is its inclusivity – anyone can enter online

**"We have recently established an industry-leading anti-doping policy to protect both teams and players"**

Savary was one of the favourites going into the tournament, although commentators expressed concern he hadn't been playing enough. "We have to practice a lot each day. For FIFA... maybe five games each day. For this [tournament], I couldn't

because I have summer work near my parents' house, and they haven't got an Xbox so I haven't trained a lot. Not at all, really." The pundits were right: Savary placed second to another

favourite, Spencer "xL HugeGorilla" Ealing, who took home \$7,000. Why choose FIFA and not more popular competitions? "I've played football in real life since I was four," he said. "I'm not bad at [real] football, I play in the seventh league in France, but I think I'm better at FIFA." ●



## Twitch vs YouTube Gaming

Gaming fans don't only watch their favourite players at live tournaments in glitzy stadiums. Live streaming video of gameplay has become incredibly popular. Leading site **twitch.tv** boasts 100 million visitors a month, has 1.5 million broadcasters, and reportedly constitutes as much as 44% of US streaming traffic.

All of that is fairly remarkable given its humble origins. Remember **justin.tv**? The streaming site started in 2007 with a single feed of founder Justin Kan's life. Naturally, that didn't last very long, and the technology behind it eventually led to **twitch.tv**, which lets gamers watch each other play and live stream eSports events.

Last September, Amazon decided the site was worth a sum in the region of almost a billion dollars. Google was also rumoured to be considering buying Twitch, but instead responded with a new YouTube site built purely around gaming. YouTube Gaming is based on the existing platform, but will sit separately – as Google notes, you can, for instance, type "call" into the search, and it will know that you want Call of Duty and not the song "Call Me Maybe".

*Forbes* revealed that Jeffrey Shih, a Hearthstone livestreamer, commands up to 20,000 viewers per night, making thousands of dollars a year from the ads that sit beside his videos – and that's before the money that comes from sponsorship deals. Who said gaming all day was a waste of time?



# Myo: making gesture recognition work

Thalmic Labs wants to make gesture recognition more functional and less intrusive.

We spoke to CEO Stephen Lake about the company's first product, the Myo armband, which uses EMG sensors on your arms to detect hand movement

**INTERACTING WITH SMART** devices can be challenging, and often involves furious hand-waving at a camera or talking to smartglasses. Now, Thalmic Labs' Myo promises to reduce such sweeping movements down to simply tapping your fingers together.

The Myo armband measures forearm muscle movements for gesture recognition. The system lets you tap your fingers to move a presentation forward, skip songs on your smartphone and take snaps with a GoPro camera. You can even use your hand as a game controller.

Thalmic Labs' trio of co-founders met at the University of Waterloo, Canada, as students. After receiving 50,000 pre-orders for the Myo, the product is now on sale in the UK for £180 inc VAT. We spoke to co-founder and CEO Stephen Lake.

## ■ How did the idea for the Myo come about?

We started working on this in 2012, with the idea of how to build a mouse for the next generation of computers. It wasn't about replacing the mice and keyboards of today, but more for when we have smartglasses, virtual reality, or wearable displays. How do we interact with those?

People have tried various things – the first Google Glass used voice control. Even if it works properly, you have the social stigma of being the woman wearing funny glasses and talking to herself on the Tube.

## How does this differ from other gesture-control systems?

Other people have tried gesture control before,



but using cameras – such as Microsoft's Kinect. But it's limited, because you have to be in front of the camera, so it only works in specific situations – in your living room in front of the TV, for example. It doesn't work out in the world. We wanted something that would work anywhere.

We started with how to detect the hands. We've evolved to use our hands for everything – our instinct is to touch things and gesticulate. We didn't want to have a glove or interface getting in the way. It was something that would fade into the background and make the technology seamlessly blend with the world around you.



**ABOVE** You can tap your fingers together to move a presentation forward

## ■ How does Myo achieve that?

It's based on medical tech called electromyography (EMG). The Myo works by sending electrical activity from your muscles to sensors that pick up the forearm muscle activations.



**LEFT** The master pod has eight sensors that pick up electrical vibes

When you make a fist or wave your finger, for example, you activate groups of muscles.

We detect the different patterns and muscles that you're using – and pick up a

tiny electrical voltage. It's not picking up pressure, movement or anything like that, as it is purely electrical.

There are eight sensors in total, with an ARM processor and Bluetooth chip in the master pod. There is also a gyroscope and an accelerometer for the motion tracking.

## ■ Can it fit different-sized arms, or those who are hairier than normal?

Larger arms, smaller arms – we spent a lot of time figuring that out. Your arm may have less hair or more hair than someone else's, a different muscle mass – this was actually one of the hardest parts, trying to account for such variations. But we've been able to develop both the sensors and the software in such a way that it calibrates away any difference in each person.

## ■ What applications are there for businesses?

A partner of ours, based in Spain, has built a software solution for surgeons in the operating theatre. They integrated Myo to let them zoom through and view different slices of MRI scans, touch-free. The surgeons are scrubbed up, so they can't touch a computer.

There are also applications in the field of industrial robotics. For example, in one case the Myo is being used to actually program and control robotic arms in a manufacturing plant for automobiles.

**ABOVE** No matter how hairy your arm, the Myo smart armband should just work



# Unveiled: Canon's 250-megapixel camera sensor

Want to read the lettering on a plane from the ground? It's possible with this sensor

The first generation of digital cameras sparked a race for more megapixels – Kodak's debut model had a mere 1.3-megapixel sensor.

How times have changed. While modern DSLRs such as Canon's own EOS 760D will have around 24 megapixels, and upper-end models will top 50 megapixels, the company has unveiled a prototype camera with 250 megapixels, stuffed into a CMOS sensor smaller than a standard 35mm full-frame sensor.

What can you do with such a ridiculous level of detail? Canon said that the sensor, when installed in an unnamed camera,

could distinguish the lettering on the side of an aeroplane from 18km away. Plane spotters and spies rejoice – celebrities and other targets, it's time to panic. Canon suggested it could also be used for surveillance, high-res measuring instruments and "the field of visual expression".

While it sounds unlikely that the 250-megapixel camera will hit even professional camera models in the near future, Canon did say it's working on a DSLR with a 120-megapixel sensor – though it didn't say when it would be available. Either way, you're going to need one heck of an SD card to hold those images.



● The CMOS sensor is APS-H size, which sits between the APS-C consumer level and professional full-frame sensors.

● The sensor measures only 29.2

x 20.2mm, but crams in 19,580 x 12,600 pixels.

● The high pixel counts mean slower read times, but Canon said its sensor boasts an "ultra-high" signal

read-out speed of 1.25 billion pixels per second thanks to circuit miniaturisation.

● It can capture video at 5fps, with a resolution 30 times that of 4K.

● The sensor is small enough to fit inside a DSLR, such as this prototype, but Canon say it's more likely to find a home in professional imaging equipment.

# Crowdfund this!

Our pick of UK tech projects on Kickstarter and Indiegogo

## See Sense ICON connected bike light



Why would a bike light need to be connected? Because these days, we connect everything. But there are benefits beyond turning your lights on and off with a smartphone – which is one of the features, naturally.

For example, you can adjust the brightness to extend the runtime of the lights if you're running low on battery power. And ICON isn't just a smart light, it makes your bike smart, too. For example, it sends a notification to your smartphone if someone is meddling with your bike, and pings an alert with your location if it senses you've been involved in an accident.

**Sounds like a bright idea.** Is that the best you can do? Anyway, it's even smarter than that, for this is a truly "intelligent" bike light. That means it has sensors built in that judge the road conditions, and tweak the light in response. If it becomes darker, the light gets brighter; come up to a junction, and the light can flash more quickly to make you more visible to cars. Plus, new features will be added with ongoing Bluetooth firmware updates.

**Can it track location and speed?** The app doesn't support the sort of tracking that bike computers perform, but the data appears to be available. Indeed, the Belfast developers suggested the aggregated data from the ICON lights can be used by councils to help design smarter cities, tracking routes taken, crashes, road surface conditions and more. If you don't want your data collected, you can opt out.



**What about the lights themselves?** Average cyclists should only need to charge the ICON lights once a week, with a five-hour charge lasting for 15 hours of road time. It uses dual LEDs that are bright enough to be seen in daylight and features side illumination, boosted with a lens to help increase visibility from every angle. Handily for British cyclists, it's waterproof.

**Will this get backed?** It already has. At the time of writing, See Sense had exceeded its £24,000 goal by more than half, well ahead of the 24 October deadline. A set of front and rear lights costs £94, with shipping expected to start in January. For an extra £20, you'll get an even brighter version.

LINK: [pcpro.link/254light](http://pcpro.link/254light)





# Geek Day Out: Novelty Automation

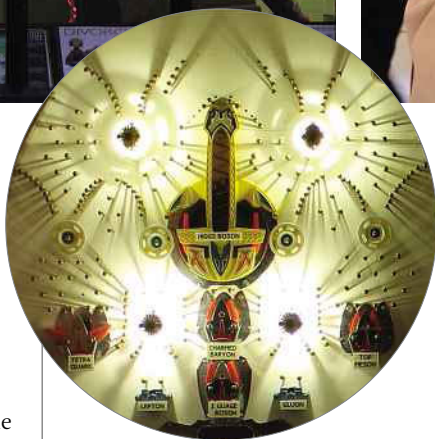
Take a trip to the arcade, but don't expect Mortal Kombat – this collection of games is a bit different



A money-laundering machine where you pick up cash and try to dodge “regulators”, an art critic simulator, a race to get divorced and a game called Pet or Meat that has a messy ending. Novelty Automation is an arcade unlike any other – well, except its sister location in Southwold.

Tim Hunkin first built his cave of automated wonders on the seaside town’s pier, but has now expanded to London. “I’ve always made things to entertain people. The coin-op machines started as a hobby, but they gradually took over my life,” he explained. “For the last 14 years I’ve run an arcade called The Under The Pier Show on Southwold Pier, but I ran out of space because I keep building new machines. A year ago, I was offered the use of a fabulous building in central London.”

The new location, in a historic shop near Holborn, has 20 unique machines to play. “You can practice



money laundering, operate a nuclear reactor, play pong on bicycles, meet a real alien’s mum, get divorced, amongst other things,” he said. “The machines are satirical – I used to be a cartoonist.”

Hunkin designs and builds the games himself. “All the machines are one-offs,” he said. “I love the process of inventing them, but it always takes a while to sort out the bugs.”

What does it take to build your own automated arcade games? “I mostly use factory automation

**ABOVE** The Autofrisk machine replicates the experience of airport security

**LEFT** Discover the elusive God particle on the Small Hadron Collider game

components, often bought on eBay. I then use Mitsubishi programmable logic controllers (PLCs) to control everything, partly because I know the programming language well, but also because they are incredibly reliable. I now have about 50 running all day in my machines, most for over ten years. I’ve only ever had one fail.”

While some of the games are undoubtedly geared towards adults – the next project involves a model of a Beverly Hills mansion, which you fly a drone around to take “compromising” pictures of the celebrities inside – Hunkin said he hopes that it also appeals to children. “It seems to work for all ages. I hope

**“I now have about 50 PLCs running all day in my machines, most for over ten years. I’ve only ever had one fail”**

I’m doing what Pixar did for animated films.”

There is one group Hunkin is hoping to attract: tourists. “I’m a Londoner,” he explained.

“I love the history of the city and it’s always had a tradition of popular entertainment. At the moment, our visitors are mostly geeks and local office workers, but no tourists.”

Entry to both shows is free, but you’ll need to buy tokens to play the games. For more details, visit the sites [novelty-automation.com](http://novelty-automation.com) or [underthepier.com](http://underthepier.com)

**LEFT** Other machines include Barry White’s Love Line and the My-Nuke reactor



# Hey Siri, who's smarter than you?

Smartphone helpers are only the first generation of digital assistants, with new developments offering major improvements for businesses and consumers

Siri, Google Now, Cortana – whatever your smartphone OS, you have access to a smart assistant. But they're only the beginning, as virtual helpers are moving off the smartphone.

"[Virtual assistants] are not destined to sit in a phone like some kind of mega-watt app," said Dr Chris Brauer, director of innovation at Goldsmiths, University of London. "The greatest utility will come as they interact across domains – in your car, on your watch, on your TV, and in your home."

Virtual assistants (VAs) are already expanding: Amazon's Echo sits in your living room, ready to answer any question you ask, while Siri is built into the newly announced Apple TV.

At the moment, most virtual assistants are limited in what they can understand. Give Siri an easy question and it excels, but ask for anything other than basic facts and it stumbles.

This is why Facebook M is using human helpers to augment its answers. "VAs are learning machines, individually and collectively, so for the time being it makes sense for humans to 'coach' VAs for improving functionality and services," said Dr Brauer. "In the near future, it will probably invert and it will be predominantly VAs coaching humans for improved decision-making and rationality."

## Next-gen helpers

Some virtual assistants are already beginning to handle complex queries, with Viv Labs' assistant being able to tie ideas together: ask for a wine that goes well with fish to buy on the way home, and it will know your route, recommending a shop and bottle. SoundHound's Hound can run equally complex searches: ask it to book a hotel in Cardiff with



ABOVE Digital assistants are starting to move off smartphones and tablets

free Wi-Fi for less than £200, and it will suggest a selection.

More research will allow voice assistants to better understand our natural speech patterns and consider multiple questions at once. "It's a perfect storm of research and investment in deep learning, voice recognition, neural networks, language processing, and techniques such as 'reinforcement learning', which helps machines observe experiences," said Dr Brauer.

## Business assistants

The potential for virtual assistants is huge in the private sector: "Innovations and applications behind the corporate or industrial curtain are having the most immediate impact," said Brauer.

IBM bought virtual assistant Cognition to work with AI supercomputer Watson, while IPSoft's Amelia AI helper can respond to customer service requests using natural language.

The inevitable downside: these digital helpers may eventually end up putting humans out of call centre jobs in the same way robots have made production line workers redundant.



RIGHT Amazon's Echo is just the start

## Best of alphr.com

Our sister site Alphr covers the latest in tech and science – here are the top stories from this month on the innovations that are just over the horizon

### Hearts reanimated for transplants

The waiting time for a new heart is six months in the UK, partly because hearts for transplant must be harvested while the donor is still alive – so they're only taken from brain-dead patients. However, TransMedics may have solved that problem: its organ care system "reanimates" recently dead hearts by pumping in blood and oxygen so they can be used for transplants. So far, it's been used successfully 15 times in the UK and Australia.

[pcpro.link/254alphr1](http://pcpro.link/254alphr1)



### Control your smartwatch from a "tattoo"

Forget trying to control your wearable via its tiny screen – now you can install a connected tattoo onto your own skin. Created by Saarland University and the Max Planck Institute for Informatics, iSkin is a silicon rubber tattoo with pressure-sensitive sensors that can be attached to any part of your skin. You can tap it to answer calls, play music and even type messages. iSkin requires a wired connection, but the developers are hoping to use wireless chips.

[pcpro.link/254alphr2](http://pcpro.link/254alphr2)



### Spaced-out broadband

A paper written by Samsung Research America president, Farooq Khan, has suggested building a network of 4,600 microsatellites in low orbit around Earth, in order to offer truly global internet access. Each satellite would sit 930 miles above the planet and transmit terabytes of data per second, helping to reduce the burden on wired networks. Google, Elon Musk's SpaceX and Virgin are all considering the idea.

[pcpro.link/254alphr3](http://pcpro.link/254alphr3)







# Jon Honeyball sees a future where autonomous cars save us from our complacent selves

I passed my driving test in 1981, a year that saw 172 billion “vehicle miles” driven on British roads. By 2014, according to the government’s statistics, the annual figure had almost doubled to 311 billion vehicle miles.

In the same 33-year time frame, vehicles themselves have moved on in an incredible way. Back then, the anti-lock braking system (ABS) was a new thing available on only the most expensive of cars. Airbags were just as rare, while the early crash-testing of cars highlighted the complete horrors that were being sold to unsuspecting customers every day.

Today we have radar-based cruise control that can fire the brakes or perform an emergency stop without the intervention of the driver. The crash-testing and, most emphatically, the computer-based modelling of car structures, means the overall “crashworthiness” of cars is incomparable to those produced in the 1970s and 80s. Air conditioning is now a common feature, so the old-style fogged-up cars are a thing of the past. Even the arrival of laminated glass has had a significant effect, and I could rant on about LED lighting and even laser-guided headlights too.

Why am I pointing all of this out? It’s because the standard of driving is getting worse. We rely on these systems, meaning driving has turned from an exercise that required effort, both mental and physical, to something almost automatic. I used to be as guilty of this as everyone else: my commute of ten miles to the lab had turned into something where I could completely tune out, listening to the dulcet tones of John Humphrys on Radio 4. I would often arrive at the lab car park with little or no memory of the journey I had just completed.

This worried me a lot. I decided to do something about it: to get my motorcycle licence. This was revelatory, and now I thoroughly enjoy riding my motorbikes both for work and pleasure. I would strongly argue that on a bike you need to have a vastly higher level of awareness of what is going on around you, both in terms of other vehicles and the environment – that is, the road surface, weather and lighting. This is necessary because you will end up in an accident otherwise, and on a motorbike (or pushbike) it is you who will get hurt. We

two-wheeled riders have a term for the zoned-out car driver: such a road-user is called a SMIDSY, which stands for “sorry mate I didn’t see you”.

So how does this impact on car driving? Well, I admit I have some quite radical views about zoned-out drivers these days. That’s especially true for those who decide to read their emails, have a phone held on their ear, or even read a book propped up against the steering wheel. Or do their makeup in the rear-view mirror.

The statistical reality is that these are probably at least half of the drivers on the road, given the shape of a standard normal distribution curve. These are the ones who are not awake or aware, and can allow themselves that luxury because cars are now so safe. I read somewhere that Volvo is aiming for no-one to die in their cars as a result of an accident in 2020. This is a staggeringly ambitious target to aim for, and I applaud them for it.

**“Getting disinterested and distracted drivers into self-driving cars will have a positive impact on the roads”**

However, the sooner we can get to workable autonomous vehicles, the better for everyone. Getting those disinterested and distracted drivers into self-driving cars will have a hugely positive impact on the roads. Safety would increase, and it’s quite likely that throughput per mile could be improved too, because an autonomous car could drive at the correct speed for the conditions. In the future, it’s possible that such vehicles could recognise

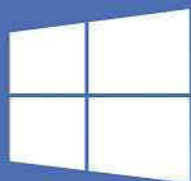
each other, and go for a closer packing on the road. We might even see an end to the middle-lane hogger, who simply doesn’t care about having any semblance of lane discipline.

Active driving will be left to those who can actually be bothered to spend effort both in the activity, and in the ongoing, regular training that should be brought in to back up the licence – a licence, incidentally, that should require a test every five years. After all, with an autonomous car, the driver should have no need of a licence, or even insurance. And I can’t help but look forward with abject glee to the wholesale filleting of the insurance industry that is to come.

But a niggling thought still plagues me: will the future SMIDSY, “sorry mate I didn’t see you”, just transform into a robotic voice that the car shouts out, instead of the driver, as it sideswipes a cyclist or biker? Oh dear, maybe this won’t be progress after all.

■ Jon Honeyball is a contributing editor to *PC Pro*. To him, happiness is a warm sunny day and a red Ducati Panigale 1199S. Email [jon@jonhoneyball.com](mailto:jon@jonhoneyball.com)





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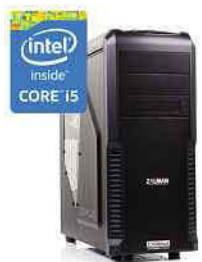
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